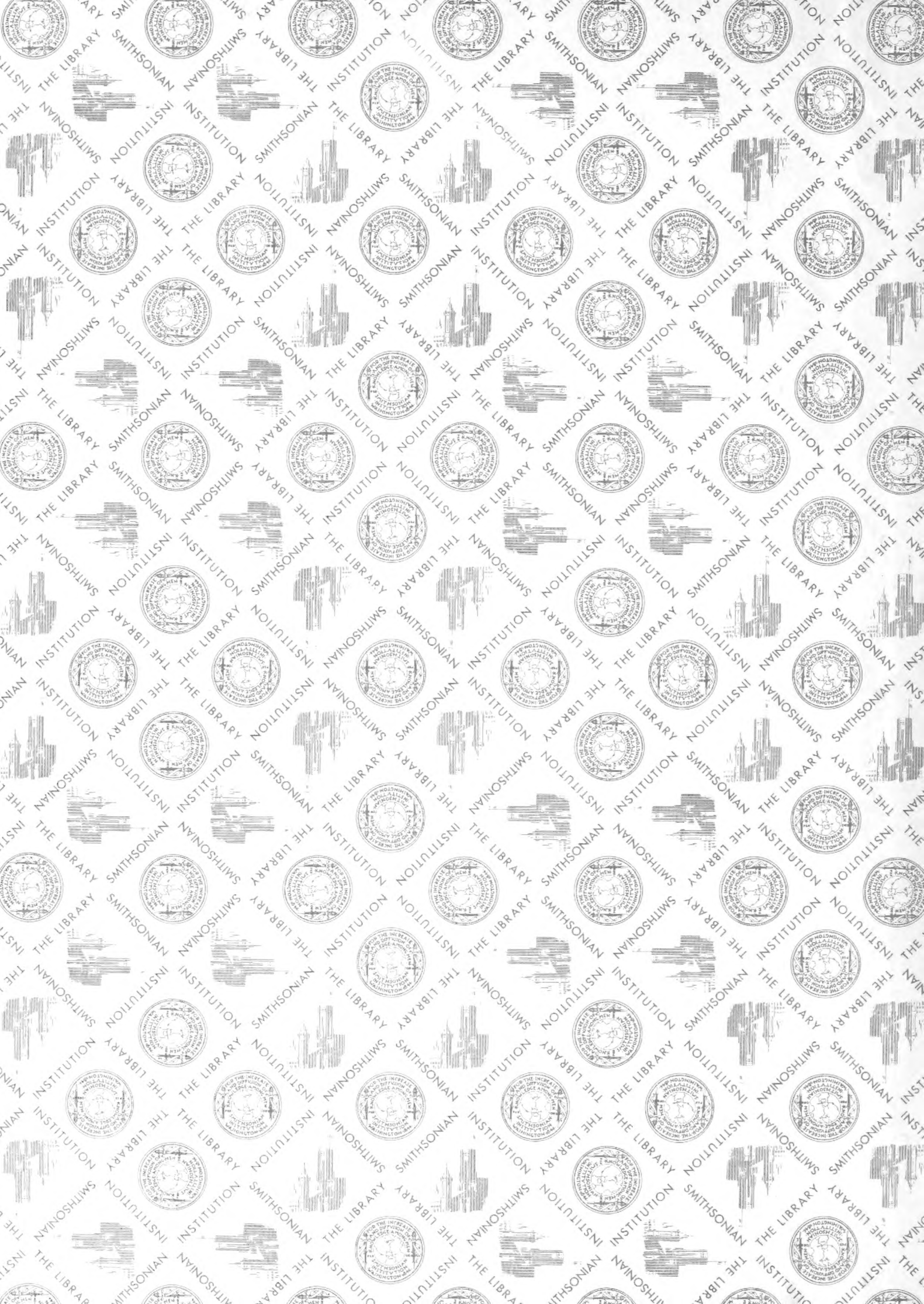


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IX. *A Monograph of the Ostracoda of the Antwerp Crag.* By GEORGE STEWARDSON  
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[PLATES LXII. to LXIX.]

AFTER examining and carefully studying a very interesting collection of Ostracoda from the neighbourhood of Antwerp, which has, with great courtesy, been submitted to me by M. Ernest Vanden Broeck, I regret that I am unable to point to any facts of distribution or grouping which can throw the slightest light upon the age or mutual relations of the strata in which they occur. The general character of the collection is about as different as well could be from that of the group described and figured by Professor T. Rupert Jones in his 'Monograph of the Tertiary Entomostraca of England.' Indeed, of the fifty species described in the present memoir, eight only enter into Professor Jones's list—viz. *Cythere woodiana*, *C. plicata*, *C. wetherellii*, *C. macropora*, *C. scabropapulosa*, *C. jonesii*, *Cytheridea pinguis*, and *C. mülleri*; and of these eight, three (*C. woodiana*, *wetherellii*, and *scabropapulosa*) are of extremely rare occurrence in M. Van den Broeck's collection. Under these circumstances it is obviously impossible, in the present state of our knowledge, to institute any useful comparison between the Tertiary Ostracoda of England and Holland. One noteworthy point in the collection, however, is this—the entire absence of freshwater species. Prof. Jones's memoir contains eight freshwater species from the Eocene and Pleistocene deposits of England; M. Bosquet's Monograph of the French and Belgian species, on the other hand, has no freshwater species; neither, to all appearance, have the smaller works of MM. Speyer and Egger. In the case of the Antwerp specimens it would appear that the fauna was deposited in water of a moderate depth, probably not less than 15 or 20 fathoms.

In the following Table the number of asterisks roughly indicates the comparative abundance of the different species:—*one* asterisk denoting scarcity; *two*, moderate quantity; and *three*, the greatest abundance.



Species.	SABLES INFÉRIEURS.			SABLES MOYENS.		SABLES SUPÉRIEURS.
	Pectunculus-zone.	Panopæa-zone.		Zone à Bryozaires.	Zone à Isocardium cor.	Zone à Trophon antiquum.
		Kiel.	Edeghem.			
†Paracypris polita, Sars.....	*	*				
†Pontocypris faba (Reuss).....	....	....	*	**		
†—— propinqua, Brady.....	....	....	....	**		
Bairdia oviformis, Speyer.....	....	....	....	....	*	
Cythere cribrosa, B., C., & R. ....	....	....	....	....	*	*
—— woodiana, Jones.....	....	....	....	....	....	*
—— ellipsoidea, Brady.....	....	....	....	*	*	
†—— jurinei, Münster.....	***	***	....	....	....	*
—— plicata, Münster.....	....	....	*	**	**	**
†—— belgica, Brady.....	....	....	....	....	....	*
†—— plicatula (Reuss).....	....	....	....	....	*	
†—— cicatricosa (Reuss).....	....	....	....	*	*	**
—— cœdichilus, Brady.....	**	....	....	*	....	*
—— petrosa, Brady.....	....	....	....	*		
†—— limicola (Norman).....	....	....	....	....	*	
†—— latimarginata, Speyer.....	***	***	***	**	*	*
—— wetherellii, Jones.....	**	**	**			
†—— tarentina, Baird.....	**	**	*			
—— acuticosta, Egger.....	**	....	*			
—— trapezia, Brady.....	....	....	....	....	....	*
†—— macropora, Bosquet.....	....	***	***	***	*	
—— polytrema, Brady.....	**	*	*	....	***	
—— scabropapulosa, Jones.....	*	....	....	....		
—— dawsoni?, B. & C. ....	....	*	....	....	*	*
?—— subcoronata, Speyer.....	*	....	....	....	*	
†—— mucronata, Sars.....	....	....	....	*		
†—— jonesii (Baird).....	**	*	*	*	***	
—— lima, Reuss.....	....	*	....			
†Cytheridea papillosa, Bosquet, var. lævis....	***	***	*	....	***	*
—— pinguis, Jones.....	***	***	*	....	***	*
†—— cypridioides, Brady.....	....	....	....	**		
†—— mülleri, Münster.....	***	***	***	***	....	*
Loxoconcha latissima, Brady.....	**	....	*	***		
—— bitruncata, Brady.....	....	....	....	....	**	***
—— grateloupiana (Bosquet).....	*	....	*	....	*	
†—— variolata, Brady.....	**	*	*	***		
†Xestoleberis depressa, Sars.....	....	....	....	***		
†Cytherura broeckiana, Brady.....	*	*	*			
†—— cornuta, Brady.....	....	....	*	*		
†Cytheropteron latissimum (Norman).....	....	*	*	*		
—— intermedium, Brady.....	....	....	*			
—— gradatum (Bosquet).....	*	....	....	*		
—— pipistrella, Brady.....	....	....	....	**		
†Bythocythere constricta, Sars.....	....	....	....	*		
†Cytherideis lithodomoides (Bosquet).....	***	**	....	***		***
—— recta, Brady.....	....	....	....	*		
†Paradoxostoma ensiforme, Brady.....	....	....	....	*		
†Cytherella parallela (Reuss).....	*	....	*	....	*	
—— elliptica, Brady.....	....	*	....			
—— nodosa, Brady.....	**	**	*			

† The species marked thus are known as still living.

‡ These are so closely allied to



Family CYPRIDÆ.

Genus PARACYPRIS, G. O. Sars.

Shell smooth, compact, higher in front than behind. Upper antennæ shortly setiferous, lower strongly clawed. Second maxilla having a branchial appendage, palp elongated, conical, and inarticulate. Last pair of feet like the first, and ending in a long curved claw. Postabdominal rami large, ending in two strong curved claws and a short seta; on the posterior margin two long setæ. One eye.

PARACYPRIS POLITA, Sars. (Plate LXIII. figs. 5 a-5 d.)

*Paracypris polita*, G. O. Sars, Oversigt af Norges Marine Ostracoder, p. 12 (1865).

*Paracypris polita*, Brady, Monograph of Recent British Ostracoda, p. 378, pl. xxvii. figs. 1-4, and pl. xxxviii. fig. 2 (1868).

*Paracypris polita*, Brady, Crosskey, and Robertson, Monograph of the Post-tertiary Entomostraca of Scotland, &c., p. 131, plate xv. figs. 9, 10 (1874).

Carapace, as seen from the side, elongated, siliquose or subtriangular, highest in front of the middle; height equal to rather more than one third of the length; anterior margin evenly rounded, posterior sharply attenuated; dorsal margin well arched, sloping steeply behind, ventral margin more or less sinuated in the middle. Seen from above, the outline is compressed, oblong, tapering evenly to the extremities; greatest width situated near the middle and equal to more than a quarter of the length. The left valve overlaps the right in the middle of the ventral surface. End view broadly ovate. Surface smooth. Length  $\frac{1}{25}$  inch (1 millimètre).

One or two specimens only were found in the *Pectunculus* and *Panopæa-menardi* beds of the "Sables inférieurs."

In the living state the species occurs, though not very commonly, in the North Sea off the coasts of Great Britain and Norway. It has been noticed also sparingly as a fossil in the Post-tertiary beds of Norway and Scotland.

Genus PONTOCYPRIS, G. O. Sars.

Shell thin and fragile, higher in front than behind, elongated, subreniform or sub-

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certain living species as to make their distinction somewhat doubtful; the alliances are as follows:—

*Pontocypris faba* closely approaches *P. mytiloides* (Norman).

*Pontocypris propinqua* closely approaches *P. angustata*, Brady, and *P. trigonella*, Sars.

*Cythere belgica* closely approaches *C. plicatula*, Reuss.

*Cythere cicatricosa* closely approaches *C. convexa*, Baird.

*Cythere macropora* closely approaches *C. lactea*, Brady.

*Cytheridea cypridioides* closely approaches *C. zetlandica*, Brady.

*Loxoconcha variolata* closely approaches *L. alata*, Brady.

*Cytherura broeckiana* closely approaches *C. fulva*, Brady and Robertson.

*Cytherideis lithodomoides* closely approaches *Cytheridea elongata*, Brady.

triangular. Lower antennæ bearing, on the last joint but two, a brush of five setæ, and at the base of the same joint a pedicellated vesicle. Second maxillæ having no branchial appendage. Palp large and subpediform, 3-jointed; last joint in the female with two long, curved claws. Second pair of feet flexuous, 4-jointed; last joint short and ending in several short setæ, one of which is pectinated. Postabdominal rami large, with two curved claws and a slender seta at the apex and three long setæ on the inner margin.

PONTOCYPRIS FABA (Reuss). (Plate LXIII. figs. 6 *a*, 6 *b* (♀), 6 *c*-6 *e* (♂).

*Bairdia faba*, Reuss, "Ein Beitrag zur genaueren Kenntniss der Kreidegebilde Meklenburgs," Zeitschrift d. deutsch. geol. Ges. 1855, p. 278, pl. x. fig. 2.

Carapace of the *female*, as seen from the side, subtriangular; greatest height situated in front and equal to one half of the length; anterior extremity broadly rounded, posterior rounded but much attenuated; dorsal margin very strongly arched and highest in front of the middle; ventral almost straight, slightly sinuated. Seen from above, oblong-ovate, tapering suddenly in front and very gradually toward the posterior extremity; greatest width situated at the anterior third, and equal to more than one third of the length. The right valve overlaps the left in the middle of the ventral surface. Surface smooth or slightly granulated. The *male* differs from the female in the greater size of the shell, in its more attenuated proportions, and in being subacuminate at the hinder extremity. Length of female  $\frac{1}{40}$ , of male  $\frac{1}{35}$  inch (0.65, 0.75 millim.).

Several examples were found in the bed "à Bryozoaires" of the "Sables moyens," and a few in the "*Panopæa menardi*" bed (Sables inférieurs). The reference of the two forms figured in Pl. LXIII. to the male and female sexes, respectively, is of course hypothetical; but the general characters of the two forms are so similar, and the points of difference are so exactly those which we observe as sexual distinctions among the recent Ostracoda, that I entertain very little doubt as to the correctness of the diagnosis. Reuss's figure of a single valve of his "*Bairdia faba*" agrees exactly with the present species; I therefore do not hesitate to adopt that name. The recent *Pontocypris mytiloides* approaches it also very closely in general character. I think it very probable that Egger's *Bairdia dactylus* and its variety *punctata* may also be identical with this species; but the figures given by that author are unfortunately so extremely coarse that it is impossible in many cases to make an accurate diagnosis.

PONTOCYPRIS PROPINQUA, nov. sp. (Plate LXIII. figs. 4 *a*-4 *c*.)

Carapace, seen laterally, subtriangular, highest in the middle; height equal to half the length; anterior extremity evenly, posterior obliquely rounded; superior margin boldly and evenly arched, inferior nearly straight. Seen from above, the outline is ovate, pointed in front and obtusely rounded behind; greatest width situated in the

middle, and equal to somewhat less than one half the length. End view subcircular. Surface of the shell perfectly smooth. Length  $\frac{1}{35}$  inch (0.75 millim.).

A few specimens only in the "Sables moyens," zone à Bryozoaires.

This species, when seen laterally, is very like *P. trigonella*, Sars, but is less attenuated, and when seen from above is found to be much more tumid.

#### Genus BAIRDIA, M'Coy.

Valves unequal in size, the left much the larger and overlapping on the dorsal and ventral surfaces. Shell nearly or quite smooth, mostly subrhomboidal or subtriangular. Eyes wanting. Antennæ robust; the upper 6-jointed, the first two joints being large and thick, the rest short and bearing long setæ. Lower antennæ 5-jointed, the second joint having on its base a bisetose tubercle. Mandibles large, having six or seven long, strongly serrulated teeth; palp 4-jointed, bearing a small trisetose branchial plate. One pair of jaws only, 3-branched, and bearing a well-developed branchial appendage. Three pairs of feet, all alike, directed forwards and protruding from the shell, 4-jointed, and clawed at extremity; first pair bearing at the base a large ovate branchial lamina. Postabdominal rami short, clawed and setose.

BAIRDIA OVIFORMIS, Speyer. (Plate LXIII. figs. 7a-7c.)

*Bairdia oviformis*, Speyer, Die Ostracoden der Casseler Tertiärbildungen (1863), p. 44. pl. i. fig. 6.

Carapace, as seen from the side, broadly subtriangular, approaching to elliptical; greatest height situated in the middle and equal to two thirds of the length; anterior extremity broad, obliquely rounded; posterior broad and slightly produced, so as to form an almost obsolete beak; dorsal margin strongly arched; inferior slightly convex. Seen from above, the outline is regularly ovate, pointed in front and broadly mucronate behind, widest in the middle, the width being about equal to half the length. End view broadly ovate, narrower above. The right valve considerably smaller than the left, somewhat angular on the dorsal margin and distinctly beaked behind. Surface smooth. Length  $\frac{1}{17}$  inch (1.5 millim.).

One specimen only of this fine species was found in the *Isocardium-cor* bed of the "Sables moyens."

#### Fam. CYTHERIDÆ.

##### Genus CYTHERE, Müller.

Valves unequal, mostly oblong-ovate, subreniform or subquadrate; surface smooth, punctate, rugose, spinous or tuberculated, usually bearing a rounded, polished tubercle over the anterior hinge-joint. Hinge formed on the right valve by two terminal teeth, on the left by one anterior tooth and a posterior fossa, between which there is often a

bar which is received into a furrow of the opposite valve; the teeth sometimes crenulate, and sometimes wanting on the left valve. Antennæ robust; superior 5-6-jointed, and bearing on the anterior margin three curved spines; inferior 4-jointed. Mandibular palp 3-4-jointed, bearing in place of a branchial appendage a tuft of setæ. Eyes one or two<sup>1</sup>.

? CYTHERE CRIBROSA, B., C., & R. (Plate LXIV. figs. 4 *a*, 4 *b*.)

*Cythere cribrosa*, Brady, Crosskey, and Robertson, Monograph of Post-tert. Entom. of Scotland, &c., p. 146, pl. x. figs. 5-7.

Carapace compressed, oblong, subreniform; seen from the side, the anterior extremity is evenly rounded, the posterior oblique and ending above in an obtuse angle; dorsal margin nearly straight, ventral rather deeply sinuated in the middle. Height scarcely equal to half the length. The outline, when seen from above, is evenly compressed, oblong, nearly of equal diameter throughout, the extremities being rather obtuse. The surface of the shell is reticulated, the meshes uniting into obscure longitudinal furrows on the ventral surface. Length  $\frac{1}{44}$  inch (0.55 millim.).

Of rare occurrence in the *Trophon*- and *Isocardium*-beds.

CYTHERE WOODIANA, Jones. (Plate LXV. figs. 4 *a*, 4 *b*.)

*Cythere woodiana*, Jones, Monogr. Tert. Entom. England, p. 29, pl. iii. figs. 2*a*-2*g*.

Carapace, seen laterally, oblong subquadrangular; anterior extremity oblique, slightly rounded; posterior scarcely rounded, almost truncate; superior margin almost straight, inferior very slightly convex; height equal to half the length. Seen from above, the outline is oblong-ovate, widest behind the middle. The surface is thickly covered with large rounded or subangular punctations. Length  $\frac{1}{20}$  inch (1.3 millim.).

This is one of the most abundant and characteristic of the Ostracoda of the Pliocene Crag of Suffolk (England). Two detached valves have been found in the "Sables supérieurs" of Antwerp, *Trophon-antiquum* bed. The lower or Suffolk Crag, in which only the English specimens of *C. woodiana* have been found, is that known as the "Coralline" Crag, though, as stated by Professor Rupert Jones, that designation is quite inapplicable, the characteristic fossils of the deposit being not Corals or Corallines, but Sponges and Bryozoa (Polyzoa).

CYTHERE ELLIPSOIDEA, nov. sp. (Plate LXV. figs. 1 *a*-1 *d*.)

Carapace, seen from the side, subelliptical; height equal to more than half the length and nearly uniform throughout; extremities rounded; dorsal margin very slightly arched, having a slight projection over each hinge-joint fore and aft; ventral margin

<sup>1</sup> In the generic definitions given in this Memoir, I have not thought it desirable to include every anatomical detail, but have been content to give only the more important features.



rather convex, with a slight sinuation in the middle. Outline, seen dorsally, oblong, subpentagonal, widest near the posterior extremity; greatest width equalling half the length; anterior extremity broad, subtruncate, and slightly emarginate in the middle; posterior tapering abruptly to a bifid submucronate point. End view broadly subtriangular. Surface of the shell somewhat undulated and marked with impressed puncta, which are irregularly scattered and of various sizes, being larger towards the anterior and ventral margins, where they are arranged more or less regularly in the direction of longitudinal furrows. The left valve is larger than the right; and the junction of the valves on the hinge-line is marked on the dorsal surface by a deep longitudinal depression. Length  $\frac{1}{2}\frac{1}{3}$  inch (1.1 millim.).

This species seems to be of rare occurrence, only one or two examples having been noticed in the zones "à Bryozoaires" and "*Isocardium cor*." It approaches closely to Speyer's *Cythere millepunctata*, with which I was at one time disposed to identify it; and I am not sure that Speyer's figures may not represent the young form of the species.

CY THERE JURINEI, Münster. (Plate LXV. figs. 2 a-2 h.)

*Cythere jurinei*, Von Münster, Jahrbuch für Mineralogie, &c., 1830, p. 60, et 1835, p. 445 (fide Bosquet).

*Cythere jurinei*, Römer, op. cit. 1838, p. 516, pl. vi. fig. 12.

*Cythere jurinei*, Bosquet, Entom. fossil. des terrains Tertiaires de la France et de la Belgique, p. 56, pl. ii. figs. 9 a, b, c, d (1852).

*Cythere jurinei*, idem, var.  $\beta$ . *tenuipunctata*, op. cit. pl. ii. figs. 10, a, b, c, d.

*Cythere jurinei*, Egger, Die Ostrak. der Miocän-Schichten bei Orenburg in Nieder-Bayern (1858) p. 20, pl. iii. fig. 5 (icones malæ), var. *ovata*, pl. iii. fig. 4.

*Cythere jurinei*, Speyer, Die Ostrac. der Casseler Tertiärbildungen (1863), p. 15, pl. ii. fig. 5.

? *Bairdia semipunctata*, Bornemann, "Die mikroskopische Fauna des Septarienthones von Hermsdorf bei Berlin," Zeitschrift d. deutsch. geol. Ges. 1855, p. 359, pl. xxi. fig. 1.

Carapace, seen laterally, oblong, higher in front than behind, the greatest height being equal to half the length; anterior extremity obliquely rounded, posterior rounded, often much narrowed and produced; dorsal margin very gently arched, ventral slightly sinuated in the middle. Seen from above, the outline is oblong-ovate, tapering towards each extremity, the greatest width situated behind the middle. The surface of the shell is either quite smooth, or marked along the middle or on the lower half of each valve with small impressed puncta, usually faint and arranged in curved longitudinal furrows. The right valve is smaller than the left, and is abruptly sinuated at each end of the dorsal margin. Length  $\frac{1}{2}\frac{1}{3}$  inch (1.1 millim.).

Figs. e-h represent, as I believe, the adult form of the species, whereas an immature stage is shown in the figures a-d, which also seem to be identical with the var.  $\beta$ . *tenuipunctata* of M. Bosquet. It is not uncommon in recent Ostracoda to find the young marked with delicate sculpturing, which disappears in advanced age; the shape and

proportions of the shell are also liable to considerable variation during the process of growth.

*Cythere jurinei* occurs in moderate abundance in the *Pectunculus* and *Panopæa-menardi* beds (Sables inférieurs), also in the *Trophon-antiquum* bed (Sables supérieurs).

CY THERE PLICATA, Münster. (Plate LXV. figs. 5 *a*–5 *d*.)

*Cythere plicata*, Münster, Jahrb. für Mineralogie, &c., 1830, p. 63, and Neues Jahrb. &c. 1835, p. 446 (fide Jones et Bosquet).

*Cythere plicata*, Römer, Neues Jahrb. für Min. &c. 1838, p. 518, pl. vi. fig. 26 (fide Jones et Bosquet).

*Cypridina laticosta*, Reuss, Haidinger's Abhandl. iii. p. 87, pl. ii. fig. 13.

*Cythere plicata*, Bosquet, Entom. fossil. des terr. Tertiair. de la France, &c., p. 60, tab. ii. fig. 13.

*Cythere plicata*, Jones, Tertiary Entomostraca of England, p. 32, pl. iv. fig. 16, and pl. v. figs. 8 *a*–8 *d* (? pl. v. fig. 17).

*Cythere plicata*, Egger, Die Ostrak. der Miocän-Schichten bei Orenburg (1858), p. 24, pl. v. fig. 9 (icones malæ).

*Cythere plicata*, Speyer, Die Ostrac. der Casseler Tertiärbildungen (1863), p. 29, pl. iv. figs. 2 *a, b, c, d*.

Carapace, as seen from the side, oblong, subquadrangular; length equal to rather more than twice the height. Anterior extremity wide and well rounded, posterior narrowed, and armed with three or four blunt teeth; dorsal and ventral margins nearly straight in front, but converging towards the posterior extremity. Seen from above, oblong-ovate, tapering gradually toward the front, and abruptly behind; extremities obtusely pointed; greatest width near the hinder extremity, and equal to half the length. End view irregularly quadrate, the lateral margins having each a large central prominence. The valves are marked by three large, curved and rounded longitudinal ribs, the central one being the most prominent: the ribs themselves are smooth; but the intermediate furrows are sculptured with large rounded pittings. The hinge-line is marked by a deep depression. Length  $\frac{1}{30}$  inch (0.85 millim.).

*C. plicata* occurs in moderate abundance in both beds of the "Sables moyens" and much more rarely in the *Panopæa*-bed (Sables inférieurs). It is noted by Professor Rupert Jones as occurring in the middle Eocene of the Isle of Wight and Hampshire; and the same author states that "it has been found in the Miocene deposits of Dax, and in the Eocene of France, Belgium, North-western Germany, Bohemia, Austria, and Moravia." In some of these deposits it seems to be very abundant, and, indeed, may be looked upon as one of the commonest and most widely distributed of the Tertiary Ostracoda. It is, moreover, very distinct in its characters, and scarcely likely to be confused with any other species, at any rate in its typical form.

CY THERE BELGICA, nov. sp. (Plate LXV. figs. 3 *a*, 3 *b*.)

Carapace, seen from the side, subrhomboidal, somewhat higher in front than behind; height equal to half the length; extremities obliquely rounded; dorsal margin straight, sloping gently from before backwards; ventral slightly convex. Outline, seen dorsally,

oblong-ovate, widest behind. Surface of the shell minutely and rather closely punctate, marked by two distinct but slender ribs, one of which crosses the centre of the valve somewhat obliquely in a longitudinal direction; the other lies near the ventral border, and curves upward behind to join the central rib. Length  $\frac{1}{30}$  inch (0·85 millim.).

This is not very unlike a form described by Prof. Rupert Jones under the specific name "*sphærulolineata*;" but as in some points it does not agree with the description, especially as regards the central tubercle and the "beaded" character of the ridges, I have thought it better to assign it here a new name. Only one or two specimens were found in the "Sables supérieurs."

CYTHERE PLICATULA (Reuss). (Plate LXIV. figs. 6 *a*, 6 *b*.)

*Cypridina plicatula*, Reuss, "Die fossilen Entomostr." &c., Haidinger's Abhandl. 1850, p. 44, pl. x. fig. 23, *a*, *b*.

*Cythere plicatula*, Bosquet, Entom. fossil. des terr. Tertiair. de la France, &c. p. 92, pl. x. fig. 23 *a*, *b*.

? *Cythere retifastigiata*, Jones, Tertiary Entomostraca, p. 36, pl. 3. fig. 7.

*Cythere plicatula*, Egger, op. cit. p. 38, pl. 5. figs. 6, 7, 8; Brady, "On new or imperfectly known Species of Marine Ostracoda," Trans. Zool. Soc. London, 1865, vol. v. p. 374, pl. lx. fig. 1 *a-c*.

Carapace, as seen from the side, oblong, subquadrangular, higher in front than behind; height equal to half the length; anterior extremity rounded, posterior scarcely rounded, and armed below the middle with three or four more or less prominent teeth; dorsal and ventral margins nearly straight, the former slightly elevated over the anterior hinge-joint. Outline, as seen from above, oblong-ovate. The valves are marked by three more or less distinct longitudinal ridges, the rest of the surface being covered with rather coarse angular punctations. Length  $\frac{1}{34}$  inch (0·75 millim.).

*C. plicatula* has been found in several localities, but is apparently not very common in any of them. Dr. Reuss records its occurrence in several localities in Austria, Bohemia, and Galicia; Dr. Egger in Germany, and M. Bosquet in the Miocene of the South of France, as well as in the "terrain subapennin supérieur de Perpignan." If my identification of it with the *C. retifastigiata* of Rupert Jones be correct, it has also been noticed sparingly in the Suffolk Crag ("Coralline" Crag) of England. The one specimen which I here figure and describe was found in the bed of "*Isocardium cor*" (Sables moyens d'Anvers). The species occurs at the present day living in the Levant and Eastern Mediterranean.

CYTHERE CICATRICOSA (Reuss). (Plate LXIV. figs. 3 *a*–3 *d*.)

*Cypridina cicatricosa*, Reuss, Die fossil. Entom. österreich. Tertiär-Beckens, p. 27, pl. ix. fig. 21 *a*, *b* (1849).

*Cythere cicatricosa*, Bosquet, Entom. foss. terr. Tertiair. France, p. 76, pl. iii. fig. 13 (1852); Brady,

Crosskey, and Robertson, Post-tertiary Entom. of Scotland, &c., p. 151, pl. xiv. figs. 7–10.

*Cythere arborescens*, Brady, Ann. & Mag. Nat. Hist. vol. xvi. pl. ix. figs. 5–8 (1865).

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Carapace somewhat peachstone-shaped: viewed from the side, it is highest in the middle, the height being equal to two thirds of the length; anterior extremity well rounded and broad, posterior narrower and produced into a short almost obsolete beak; dorsal margin strongly arched, inferior slightly sinuated in the middle. Seen from above, the outline is ovate, widest in the middle and tapering evenly to the pointed extremities; width equal to half the length. End view broadly ovate, narrowed above and broadly rounded below. The valves are very convex, and are marked all over the surface with rather coarse and closely-set circular punctures. Length  $\frac{1}{38}$  inch (0.66 millim.).

*C. cicatricosa* has been found in some of the Tertiary deposits of France and Germany, associated with the preceding species; also in some English Post-tertiary deposits. I do not know of its existence in the living state at the present day, unless it be considered identical with *C. convexa*, Baird, to which species I must suppose that the remarks of M. Bosquet probably refer when he speaks of its being found on the coast of Italy. Our figure and description are drawn from a specimen found in the Sables moyens d'Anvers (zone à Bryozoaires).

CY THERE ÆDICHILUS, nov. sp. (Pl. LXIV. figs. 1 *a*–1 *d*.)

Carapace, as seen from the side, subquadrangular, rather higher in front than behind; height equal to nearly two thirds of the length; anterior margin well rounded; posterior angularly produced below, rounded off obliquely above; dorsal margin sinuated in front of the middle; ventral evenly and rather strongly convex. Viewed from above, the shell is broadly ovate, tapering evenly to the extremities, both of which form broadly mucronate projections; the width in the middle is equal to half the length. End view irregularly and broadly ovate, narrowed towards the apex. The margins of the shell are much produced, rounded and swollen; just within the ventral border is a very conspicuous, thick, and rounded ridge, and near the centre of the valve a large, smooth, rounded tubercle; the rest of the surface is marked with rounded pittings, which are arranged in transverse rows. The hinge-line on the dorsal aspect is marked by a longitudinal furrow; the ventral surface shows the strongly developed marginal plates of the shell with an intervening depression. Length  $\frac{1}{34}$  inch (0.75 millim.).

This species occurs in all the three divisions of the group, inférieurs (*Pectunculus*-bed), moyens (zone à Bryozoaires), supérieurs (*Trophon*-bed).

CY THERE PETROSA, nov. sp. (Plate LXIV. figs. 5 *a*–5 *d*.)

Carapace tumid, wedge-shaped: seen from the side, subquadrangular; height nearly uniform throughout, and equal to rather more than half the length; extremities equal and obliquely rounded; dorsal and ventral margins parallel and almost perfectly straight, the dorsal being much the shorter of the two. Seen from above, the outline is ovate, very tumid behind, the greatest width being fully equal to the height, narrowed and



subtruncate in front, broadly rounded behind. End view very broadly subovate, emarginate in the middle both at base and apex. Surface of the shell irregularly furrowed or undulated in a transverse direction, and marked with distant pittings, which have a tendency to follow the lines of the furrows. Length  $\frac{1}{38}$  inch (0.66 millim.).

One specimen only of this very distinct species has occurred in the Sables moyens (zone à Bryozoaires).

CY THERE LIMICOLA (Norman). (Plate LXIV. figs. 9 *a*, 9 *b*.)

*Cythereis limicola*, Norman, Nat.-Hist. Trans. Northumberland & Durham, vol. i. p. 20, pl. vi. figs. 1-4 (1865).

*Cythere nodosa*, G. O. Sars, Oversigt af Norges marine Ostrac. p. 34 (1865).

*Cythere areolata*, Brady, Trans. Zool. Soc. Lond. vol. v. p. 381, pl. lxii. figs. 2 *a-d* (1865).

*Cythere complexa*, Brady, Brit.-Assoc. Report, p. 210 (1866).

*Cythere limicola*, Brady, Monog. Recent Brit. Ostrac. p. 405, pl. xxxi. figs. 38-41, 43-46; Brady, Crosskey, and Robertson, Monog. Post-ter. Entom. of Scotland, &c., p. 154, pl. x. figs. 1-4.

Carapace, as seen from the side, subtrapezoidal, rather higher in front than behind; height equal to about two thirds of the length; anterior extremity obliquely rounded; posterior produced in the middle and excavated above; superior margin rather concave, abruptly angular at each extremity, inferior nearly straight. Seen from above, the outline is boat-shaped, widest behind, tapering gently toward the front and abruptly behind. End view subtriangular, base broad and flat, apex obtusely rounded, sides excavated. Shell-surface uneven, rugose, often obscurely reticulated, the interstices being finely punctate; a conspicuous rounded tubercle over the anterior, and two near the posterior hinge; a strongly marked longitudinal ridge runs along the valves just within the ventral margin. Length  $\frac{1}{45}$  inch (0.54 millim.).

One valve only found in the "Sables moyens" (zone à *Isocardium cor*). *C. limicola* is tolerably common in the North Sea in a living state, and has been found in many Post-tertiary deposits in Scotland, and also in Canada.

CY THERE LATIMARGINATA, Speyer. (Plate LXIV. figs. 8 *a-8 d*.)

*Cythere latimarginata*, Speyer, Die Ostrac. der Casseler Tertiärbild. p. 22, pl. iii. figs. 3 *a-d* (1863); Brady, Crosskey, and Robertson, Monog. Post.-Tert. Entom. of Scotland, &c., p. 163, pl. xvi. fig. 6.

*Cythere abyssicola*, G. O. Sars, Oversigt af Norges marine Ostr. p. 43.

Carapace, as seen from the side, oblong, higher in front than behind; height equal to about half the length; anterior extremity broadly rounded, posterior rounded but much narrower; superior margin sloping rather steeply backwards, and twice sinuated, in front of and behind the middle; inferior margin rather deeply sinuated in the middle. Seen from above, the outline is irregularly oval and compressed, the extremities being wide and truncated; the sides only slightly convex, and marked by one or two rounded protuberances. The substance of the shell is very thick and hard; the

surface of the valves usually more or less beset with small circular pits (but sometimes quite smooth), and having a large central rounded tubercle; anterior and posterior margins produced into wide, thickened, and rounded lips, and fringed with numerous fine teeth, usually a large number in front, but only five or six behind. Length  $\frac{1}{35}$  inch (0·75 millim.).

This is perhaps the most abundant of all the species found in the Antwerp Crag, occurring in great plenty in the *Panopæa* and *Pectunculus*-beds, not quite so commonly in the sables à Bryozoaires, and is quite scarce in the *Trophon*- and *Isocardium*-beds. It is remarkable that the species has not been found in the English Tertiaries; and one specimen only is on record from the Post-tertiary deposit of Hopton Cliff, near Yarmouth. It occurs in a living condition in the northern portions of the North Sea (Norway and Shetland), also in the Gulf of St. Lawrence (Canada).

CY THERE WETHERELLII, Jones. (Plate LXIV. figs. 7a-7d.)

*Cythere wetherellii*, Jones, Quart. Journ. Geol. Soc. x. p. 161, pl. iii. fig. 9; Tertiary Entomost. England, p. 26, pl. iv. fig. 15, and pl. vi. figs. 16a-16d.

Carapace, as seen from the side, subquadrate, much higher in front than behind, greatest height equal to nearly two thirds of the length; anterior extremity broad, obliquely rounded; posterior narrowed, subtruncate, scarcely rounded; dorsal margin sloping steeply, and slightly arched; inferior somewhat convex and with a slight sinuation towards each extremity. Dorsal aspect broadly ovate, widest behind the middle, width nearly equal to the height; extremities produced into two broad mucronate processes. End view very tumid, ovate, width and height about equal. Surface of the shell beautifully and sharply reticulated, the reticulations angular (hexagonal or subhexagonal) and coalescing on the ventral surface so as to form longitudinal furrows; each valve forms a sort of curved alæform ridge along the ventral margin; and there is a large tubercle in the situation of the anterior hinge-joint, forming a distinct angle or gibbosity. Length  $\frac{1}{24}$  inch (1·05 millim.).

A few specimens only of *Cythere wetherellii* have occurred in the *Panopæa*-bed (Sables inférieurs). In England it has been found by Professor Jones in the "Middle Eocene" of the Isle of Wight.

CY THERE TARENTINA, Baird. (Plate LXIII. figs. 1a-1d.)

*Cythere tarentina*, Baird, Proc. Zool. Soc. 1850, Annulosa, pl. xviii. figs. 31-33.

Carapace, as seen from the side, somewhat wedge-shaped, much higher in front than behind, the greatest height being equal to more than half the length, and situated very near the anterior extremity; anterior margin broad and obliquely rounded; posterior narrowed almost to a point; superior margin sloping steeply, especially at the hinder end, very slightly arched; inferior gently convex, with a slight sinuation near the middle. The outline as seen from above is rhomboidal, the extremities truncate; the

greatest width in the middle and fully equal to half the length. End view subtriangular with convex sides, nearly equilateral. Surface of the shell slightly undulated, devoid of sculpture, except that a thin curved alæform ridge is developed towards the ventral margin of each valve; the anterior margin bears below the middle a variable number of short, blunt, irregular spines; and there are usually two or three of similar character at the posterior extremity of the shell; the lateral ala often has a single spine a little behind the middle; and the ventral surface of the shell is more or less marked with flexuous longitudinal grooves. Length  $\frac{1}{20}$  inch (1·3 millim.).

*Cythere tarentina* has not previously been observed in the fossil condition; but it still lives in many parts of the Mediterranean. It is a very distinct and fine species. Several specimens have been found in the sand from the *Panopæa*- and *Pectunculus*-beds.

CY THERE ACUTICOSTA, Egger. (Plate LXVI. figs. 5 a-5 d.)

*Cythere acuticosta*, Egger, op. cit. p. 40, pl. vi. fig. 7.

Carapace, as seen from the side, rhomboidal, equal in height throughout; height equal to nearly two thirds of the length; anterior margin obliquely rounded off; posterior obliquely truncate below the middle, rounded off above; dorsal margin straight; ventral also straight, except the anterior half, which is a little upturned. Seen from above, the outline is elongated, subhexagonal or subovate, sides nearly parallel but irregularly flexuous, width equal to half the length, tapering rather abruptly towards the extremities, which are pointed. End view quadrangular with irregularly waved sides, width equal to three fourths of the height. The surface of the shell is strongly sculptured with sharply cut ridges, running for the most part in a longitudinal direction, but irregularly flexed and anastomotic; one of them, more developed than the rest, is in the median line; the furrows between these ridges are excavated into pits of very irregular size and shape; the dorsal surface is marked by a very distinct longitudinal median groove with raised ridges; and the ventral surface has on each valve a flattened alæform plate which is sculptured with transverse and marginal excavations. Length  $\frac{1}{45}$  inch (0·54 millim.).

Our specimens of this species occurred in the *Pectunculus*- and *Panopæa*-beds. Though the figures given by Dr. Egger differ rather considerably (especially in the end view) from my own, I am disposed to think that they are meant to refer to the same species, and on that supposition have adopted the specific name *acuticosta*.

CY THERE TRAPEZIA, nov. sp. (Plate LXVI. figs. 4 a-4 d.)

? *Cythere corrugata*, Egger, op. cit. p. 35, pl. v. fig. 3.

Carapace, as seen laterally, trapezoidal, rather higher in front than behind, height equal to more than half the length; anterior extremity obliquely rounded; posterior subtruncate, rounded a little below, the lower angle not produced; dorsal and ventral margins nearly straight, the latter very gently situated in the middle. The outline from

above is elongated, subhexagonal, sides nearly parallel but deeply sinuated in the middle; sides gradually tapering to the anterior extremity, which is broad and truncate; posterior extremity very wide, with a wide central mucronate projection. End view broadly ovate, height and width nearly equal, outline irregularly waved. The shell-surface is sculptured with large pits, which are arranged in obscurely radiating, somewhat flexuous lines round a central tubercle; parallel to and just within the inferior margin is a distinct elevated ridge. Length  $\frac{1}{3\frac{1}{2}}$  inch (0.75 millim.).

This species may perhaps be identical with that called by Egger "*Cythere corrugata*, Reuss;" but if so Dr. Egger's identification must be wrong, as Reuss's figures certainly do not apply to the present species. It was found in the *Trophon-antiquum* bed (Sables supérieurs).

CYTHERE MACROPORA, Bosquet. (Plate LXVII. figs. 1 *a*–1 *d*, and Plate LXVI. figs. 6 *a*–6 *d*).

*Cythere macropora*, Bosquet, Entom. fossil. terr. Tertiair. France, p. 97, pl. v. fig. 2; Jones, Tert.

Entom. England, p. 35, pl. iii. figs. 9*a*–9*e*; Brady, Crosskey, and Robertson, Monog. Post-tert.

Entom. Scotland, &c., p. 159, pl. xiv. figs. 1–3.

? *Cythere logani*, Brady & Crosskey, Geological Magazine, vol. viii. (1871), pl. ii. figs. 8, 9.

*Cythere hornesi*, Speyer, op. cit. p. 32, pl. iii. fig. 7, and pl. iv. fig. 1.

Carapace, as seen from the side, oblong, quadrangular, highest near the front, height equal to fully one half the length; anterior extremity broad and well rounded, posterior rounded but narrower; dorsal and ventral margins nearly straight, the former sloping rather steeply backwards. The outline as seen from above is oblong and very irregular, the margins much jagged and waved; extremities produced, very broad and truncate, width about equal to the height. The shell-surface is beautifully sculptured with large angular pittings, which are arranged somewhat concentrically round a large rounded central tubercle; the pitted portion of the valve ends at some distance from the hinder extremity, in an irregular, curved, abrupt declivity, and is connected with the anterior margin by a series of about six short radiating ribs. The anterior margin is fringed below the middle with a series of 12–16 short blunt teeth; the posterior margin also bears about six or eight distant irregular teeth of similar character. The ventral aspect of the shell shows a very broad, prominent central ridge formed by the swollen margins of the valves, and on each side a laterally produced expansion ornamented by two longitudinal rows of deep subangular excavations. Length  $\frac{1}{2\frac{1}{4}}$  inch (1.05 millim.).

*C. macropora* occurs in both beds of "Sables moyens" (abundantly in that of the zone à Bryozoaires), and also very abundantly in the *Panopæa*-bed ("Sables inférieurs"). It is certainly one of the most distinctly marked and most beautiful of fossil Entomostraca. A recent Australian species (*Cythere lactea*) described by the present writer in 1865 (Trans. Zool. Soc. Lond. vol. v.) comes near to it in character, but is quite sufficiently distinct. The form represented in Pl. LXVI. of this Memoir seems to belong to the young, and is probably identical with *C. hornesi*, Speyer.



CYTHERE POLYTREMA, nov. sp. (Plate LXVI. figs. 1 *a*-1 *d*.)

Carapace, as seen from the side, oblong, highest in front; height equal to more than half the length; anterior extremity broad, well rounded and bordered below the middle with a number of irregularly placed, rather slender, but blunt spines; posterior extremity narrower, scarcely rounded, armed with a few (4-6) downward-pointing long and slender spines; superior margin sloping, arched and sinuated in front of the middle; inferior margin nearly straight. The outline viewed dorsally shows a central quadrangular portion with two broad extremities projecting in the middle line; width equal to about half the length. The lateral aspect of the valves is marked by three longitudinal sharply-cut ribs, one in the middle, the others just within the superior and inferior margins respectively; the lower is almost straight, the other two are curved; there is also a curved rounded ridge just within and parallel to the anterior margin; the rest of the surface is occupied by large angular excavations arranged in a reticulated manner; the dorsal and ventral surfaces show also longitudinal ribs, the intervals between which are filled with single rows of angular pits. Length  $\frac{1}{26}$  inch (0.98 millim.).

*Cythere polytrema* occurs in moderate numbers in the two beds of the Sables inférieurs and in the *Isocardium*-bed of the Sables moyens. Like the preceding, it is an extremely fine and well-marked species; but the valves seem usually to occur separate.

CYTHERE SCABROPAPULOSA, Jones. (Plate LXVI. figs. 2 *a*, 2 *b*.)

*Cythere scabropapulosa*, Jones, Tert. Entom. England, p. 31, pl. v. fig. 16.

Valves, as seen laterally, oblong, subovate, higher in front than behind; height quite equal to half the length; anterior extremity rounded; posterior narrowed, rounded, and somewhat produced in the middle; superior margin elevated in front, then sinuated, and distinctly arched behind; inferior nearly straight for the greater part of its course, curved upwards towards the posterior extremity. Dorsal outline oblong ovate, with jagged or crenate margins. The surface of the shell is closely beset with wart-like tubercles of considerable size; and the anterior portion has, just within and parallel to its margin a row of bead-like tubercles; a prominent tubercle over the anterior hinge-joint. Length  $\frac{1}{26}$  inch (0.98 millim.).

One valve only of this species was detected, in the *Pectunculus*-bed (Sables inférieurs). Professor Jones's specimens were found at Bracklesham in the Middle Eocene.

CYTHERE DAWSONI?, Brady and Crosskey. (Plate LXVI. figs. 3 *a*, 3 *b*.)

*Cythere dawsoni*, Brady and Crosskey, Geological Magazine, Feb. 1871, vol. viii. pl. ii. figs. 5, 6.

Carapace, seen from the side, oblong, subquadrate, highest in front. Greatest height equal to one half the length; anterior extremity well rounded, posterior narrower and not so fully rounded; dorsal and ventral margins nearly but not quite straight; the former with a prominence at each end. Outline as seen from above compressed, sub-

ovate, with wide projecting extremities. The valves have a rugose, tuberculated rib running diagonally across from before backward, and are otherwise irregularly sculptured in a rugose manner. Length  $\frac{1}{16}$  inch (0·98 millim.).

One specimen in the *Trophon*-bed (Sables supérieurs), one in the *Panopæa*-bed (Sables inférieurs), and one or two in the *Isocardium*-bed (Sables moyens).

In general aspect these specimens are rather like *Cythere costata*, Brady, but differ in their style of sculpture and in the fact of the postero-inferior angle being rounded off instead of being produced as in *C. costata*, with a dentate projection.

CYTHERE SUBCORONATA, Speyer. (Plate LXVII. figs. 4 *a-d*.)

*Cythere subcoronata*, Speyer, *loc. cit.* p. 38, pl. iv. fig. 9 (1863).

? *Cythere latidentata*, Bornemann, "Die mikroskop. Fauna des Septarienthones von Hermsdorf," Zeitschr. d. deutsch. geol. Ges. 1855, p. 366, pl. xxi. fig. 6.

? *Cythere horrescens*, Jones, Tertiary Entom. p. 38, pl. v. figs. 9, 17 *a*, 17 *b* (not *Cythere horrescens*, Bosquet; nor *Cythereis subcoronata*, Brady, Trans. Zool. Soc. Lond. vol. v. p. 384, 1865).

Carapace, as seen from the side, oblong, subovate, somewhat higher in front than behind; height equal to rather more than half the length; extremities rounded, the anterior armed below the middle with a series of strong, blunt, projecting spines, the posterior with a few broader and less developed somewhat triangular teeth; dorsal margin sloping in an almost straight line, but tuberculated and terminating behind in a very large and much elevated blunt spine or tubercle; ventral margin convex. Outline as seen from above subovate or almost hastate, irregularly jagged or lacinate, widest towards the hinder extremity, the width being equal to the height. End view subtriangular. The surface of the valves is beset with irregularly scattered, large, rounded tubercles, and along the ventral and dorsal margins with a row of blunt tooth-like processes. Length  $\frac{1}{16}$  inch (0·98 millim.).

Though Professor Jones's figures differ, more especially in the sharply spinous character of the armature, from the Antwerp specimens, I think it extremely likely that they really apply to mere varieties (perhaps sexual) or to stages of growth of the present species. And I also strongly suspect that the species itself, as illustrated in Pl. LXVII. figs. 2 *a-d* of this Memoir, may only be the immature form of *Cythere mucronata*, a strikingly developed specimen of which is shown in figs. 3 *a-d* of the same Plate. If the two series of figures be carefully compared, it will be seen that they differ scarcely at all, except in the degree of development of the various parts; and though I hesitate, in the absence of a series of specimens exhibiting the intermediate stages of growth, to unite them under one specific name, I really entertain very little doubt as to the propriety of doing so.

*C. subcoronata* has been found sparingly in the *Pectunculus*-bed (Sables inférieurs) and in the zone à *Isocardium* (Sables moyens).

CYTHERE MUCRONATA, Sars. (Plate LXVII. figs. 3 *a*–3 *d*.)

*Cythere mucronata*, G. O. Sars, Oversigt af Norges Marine Ostrac. p. 48.

*Cythere spinosissima*, Brady, Trans. Zool. Soc. (1865), vol. v. p. 386, pl. lx. figs. 10 *a*–*e*.

Carapace, as seen from the side, subquadrangular, of nearly equal height throughout, height equal to fully half the length; extremities rounded; superior and inferior margins nearly parallel; the entire circumference (except the upper half of the anterior margin) beset with blunt squamous spines, which are often dilated at the free extremity, those of the postero-inferior angle being very long. Seen from above, the outline is rhomboidal, much broken up with spinous projections. The sides of the valves are beset with flattened squamous spines, often so much dilated at the end as to become quite fan-shaped. End view hatchet-shaped. Length  $\frac{1}{20}$  inch (1.3 millim.).

The spinous armature of this fine species is subject to great variation in the extent of its development, the figures given in Pl. LXVII. exhibiting the most extreme form with which I am acquainted; it is found in the living state off the coasts of Norway.

The fossil specimens occurred in the "Sables moyens," zone à Bryozoaires.

CYTHERE JONESII (Baird). (Plate LXVII. figs. 2 *a*–2 *d*.)

*Cythereis jonesii*, Baird, Brit. Entom. p. 175, pl. xx. fig. 1 (1850); Norman, Nat.-Hist. Trans.

Northumberland and Durham, vol. i. p. 21, pl. vii. figs. 5–8 (1865).

*Cythere ceratoptera*, Bosquet, Entom. foss. terr. Tert. France, &c. (1852), p. 114, pl. vi. fig. 2.

*Cythereis ceratoptera*, Jones, Monog. Tert. Entom. Eng. p. 39, pl. iv. fig. 1 (1856).

? *Cythereis cornuta*, Jones, Entom. Tert. Form. Eng. p. 39, pl. iv. fig. 19.

*Cythereis fimbriata*, Norman, Ann. & Mag. Nat. Hist. ser. 3, vol. ix. pl. iii. fig. 9 (1862).

*Cythereis spectabilis*, Sars, Oversigt af Norges marine Ostrac. p. 46.

*Cythere jonesii*, Brady, Monog. Recent Brit. Ostrac. p. 418, pl. xxx. figs. 13–16 (1865); Brady,

Crosskey, and Robertson, Monog. Post-tert. Entom. Scotland, &c., p. 171, pl. xii. figs. 4–7.

Carapace, as seen from the side, oblong subovate, higher in front than behind; height equal to more than half the length; anterior extremity rounded, fringed with blunt spines; posterior also rounded, bearing a smaller number (about 5) of longer spines; dorsal and ventral margins nearly parallel and much broken up into irregular spines; over the anterior hinge is one very large and strong spine. Outline, as seen from above, rhomboidal, greatest width behind the middle and equal to about two thirds of the length. End view triangular. The surface of the valves, except along the margins, is smooth and gently undulated; there is a distinct elevated and rounded ridge just within the anterior and posterior extremities; and the general surface of the valves suddenly sinks to a lower plane at a little distance behind the middle. Length  $\frac{1}{23}$  inch (1.1 millim.).

I was at one time disposed to think that the form described by M. Bosquet as *C. ceratoptera* might well be kept apart as a distinct variety of *C. jonesii*; but, after examination of a large number of recent and fossil specimens, I now believe that there is no character sufficiently persistent to warrant even this separation, the chief variations

being in the shape, regularity, and degree of development of the spines. The spines vary in shape from that of evenly rounded blunt teeth of regular size to that of long and slender, or flat, squamous processes. In the best-developed recent specimens (those especially from the North Sea) the first-named condition occurs, and the rows of spines are arranged with much regularity; in others (as for instance in many specimens from the Mediterranean and in most of the fossil examples) the spines are less regular in arrangement, and tend either to become few, long and slender, or flattened and squamiform: but there are all shades of gradation between these extreme types. The figures in Pl. LXVII. are taken with great accuracy from a fine fossil specimen illustrating an intermediate condition, but with rather a marked tendency to a squamous form of the spines, except on the posterior margin.

*C. jonesii* occurs in all the Antwerp beds except in that of *Trophon antiquum*, but nowhere in much abundance.

#### CYTHERE LIMA, Reuss.

*Cythere lima*, Reuss, Zeitschrift d. deutsch. geol. Ges. 1855, p. 280, t. x. fig. 7.

One valve, referable apparently to this species, was found in the *Panopæa-menardi* bed; but, owing to its having been lost or mislaid, I am unfortunately not able to describe it.

#### Genus CYTHERIDEA, Bosquet.

Valves unequal, ovate or subtriangular, highest near the front; smooth or marked with scattered circular papillæ, with impressed puncta or concentric furrows; hinge composed of two crenulated crests on one valve, which articulate with depressions of the opposite valve. Upper antennæ very robust, mostly 5-jointed, spinous; lower 4-jointed. Mandibular palp 3-jointed, and having a distinct branchial appendage. Right foot of the first and second pairs of feet, in the male, different from the rest, that of the first very strong and prehensile, of the second very feeble; the apex rudimentary and destitute of a terminal claw. Eyes distinct.

#### CYTHERIDEA PAPILLOSA, Bosquet.

*Cytheridea papillosa*, Bosquet, Entom. fossil. terr. Tertiair. France, p. 42, pl. ii. fig. 5 (1852); Brady, Trans. Zool. Soc. Lond. (1865), vol. v. p. 370, pl. lviii. figs. 8a-g; Brady, Monog. Recent Brit. Ostrac., Trans. Linn. Soc. vol. xxvi. (1868) p. 423, pl. xxviii. figs. 1-6, pl. xl. fig. 1; Brady, Crosskey, and Robertson, Monog. Post-tert. Entom. Scotland, p. 176, pl. vi. figs. 12-15 (1874).

*Cythere bradii*, Norman, Nat.-Hist. Trans. Northumberland and Durham, vol. i. p. 15, pl. v. figs. 5-8 (1865).

*Cyprideis bairdii*, Sars, Oversigt af Norges Marine Ostracoder, p. 52 (1865).

Var. *lævis*. (Plate LXII. figs. 1 a-1 d.)

Carapace, as seen from the side, subovate, highest a little in front of the middle, height equal to half the length; anterior extremity broadly and evenly, posterior only



slightly rounded; dorsal margin forming a continuous curve from its highest point to the infero-posterior angle; ventral margin almost straight. Seen from above the outline is ovate, widest in the middle, and tapering evenly to the extremities, which are rather obtuse; width nearly equal to the height. End view nearly circular. Surface of the shell perfectly smooth. Length  $\frac{1}{30}$  inch (0.85 millim.).

This differs from the typical form of the species only in being entirely destitute of papillose sculpture. The papillose form (which, however, varies very much in its surface ornament) has been found in the fossil state in most of the Post-tertiary beds of Scotland, as well as in Norway and Canada, and by M. Bosquet in many of the Tertiary beds of France. In the living state it occurs plentifully in the seas off Norway and Great Britain and Spitzbergen, as well as in Baffin's Bay and the Gulf of St. Lawrence. My memoranda of the particular bed or beds in which this form occurred have unfortunately been lost.

CYTHERIDEA PINGUIS, Jones. (Plate LXII. figs. 3 a-3 d.)

*Cytheridea pinguis*, Jones, Tertiary Entomostraca of England, p. 43, pl. ii. figs. 4 a-4 h.

?*Cytheridea fabaeformis*, Speyer, op. cit. p. 52, pl. ii. fig. 1.

Carapace, as seen from the side, ovato-triangular, highest a little in front of the middle; height equal to more than half the length; extremities rounded, dorsal margin very boldly arched, almost gibbous; ventral slightly convex; seen from above the outline is ovate, scarcely at all tapering to the extremities, which are rather broadly rounded; the width is nearly the same throughout, and is equal to half the length. End view nearly circular. The shell-surface is nearly smooth, but is usually covered with closely-set small punctures. Length  $\frac{1}{27}$  inch (0.9 millim.).

Professor Jones's specimens were found in the Pliocene of Suffolk. Those described in this memoir are from all the Antwerp beds except only that of the "Sables à Bryozoaires." It is one of the more abundant species.

CYTHERIDEA CYPRIDIOIDES, nov. sp. (Plate LXIX. figs. 6 a-6 e.)

Carapace tumid, ovate: seen from the side the outline forms about two thirds of a circle, the dorsal margin being excessively arched, and the ventral slightly convex; the extremities are rounded, the posterior much the narrower and rather flattened; greatest height equal to two thirds of the length. Outline seen from above regular ovate, extremities obtuse; width equal to more than half the length. Surface of the shell perfectly smooth. Length  $\frac{1}{30}$  inch (0.85 millim.).

A few specimens of this species were found in the "Sables moyens" (zone à Bryozoaires). I am by no means sure that the form called in this memoir *C. papillosa*, var. *lævis*, may not be merely the male of this species.

CYTHERIDEA MÜLLERI (Münster). (Plate LXII. figs. 4 a-4 e.)

*Cythere mülleri*, Münster, Jahrb. für Mineralogie, 1830, p. 62, and Neues Jahrb. 1835, p. 446 (fide Jones and Bosquet).

*Cytherina mülleri*, Römer, Neues Jahrb. für Mineralogie, 1838, p. 516. t. vi. fig. 6 (fide Jones and Brady); Reuss, Haidinger's Abhandl. 1850, p. 55. pl. viii. fig. 21.

*Bairdia hagenowi*, Reuss, Zeitsch. d. deutsch. geol. Ges. 1855, p. 60, pl. ix. fig. 93.

*Cytheridea heterostigma*, Reuss, ibid. p. 60, pl. ix. fig. 94.

*Cytheridea mülleri*, Bosquet, Entom. foss. terr. Tert. France, p. 39, pl. ii. fig. 4; Jones, Tert. Entom. England, p. 41, pl. v. figs. 4a-4c & 5, pl. vi. figs. 10a, 10b, & 11-13; Egger, Die Ostrak. der Miocän-Schicht. Orenburg, p. 18, pl. ii. fig. 7; Speyer, Die Ostrac. der Casseler Tertiärbild. p. 48, pl. i. fig. 8; Brady, Trans. Zool. Soc. Lond. v. p. 371, pl. lviii. figs. 11a-d.

*Cytherina intermedia*, Reuss, Haidinger's Abhandl. iii. p. 86, pl. xi. fig. 12.

*Cytherina seminulum*, Reuss, ibid. p. 59, pl. ix. figs. 5-8.

Carapace of the female subovate, tumid: seen from the side, ovate-triangular, highest a little in front of the middle; height equal to rather more than half the length; anterior extremity well rounded, posterior narrowed, obliquely rounded, and often somewhat exserted at the inferior part, forming a rounded obtuse angle; dorsal margin arched, usually more or less angulated in front of the middle; ventral margin nearly straight. Seen from above, ovate, sides subparallel, tapering abruptly to the extremities, width less than half the length. End view very broadly ovate. The surface is marked with numerous impressed rounded punctures, which often tend to arrange themselves in curved transverse furrows, and on the ventral surface to coalesce into longitudinal furrows; the margins are often entirely smooth; but frequently the anterior border is armed below the middle with a row of six or eight sharp spines on each valve; the posterior extremity also sometimes bears a single spine at its lower angle; this is situated on the *right* valve. The shell of the male is, as usual, more compressed and elongated. Length  $\frac{1}{27}$  inch (0.9 millim.).

This is one of the most common species in the Antwerp beds, and has been found in all of them except the zone of *Isocardium cor.*; it has also been found in most of the Tertiary formations of Europe, in Austria, Bohemia, Hesse, Westphalia, France, and the Netherlands (Eocene), in Touraine (Miocene) and in the Netherlands (Pliocene); it has also been noticed by Professor Rupert Jones in many of the Tertiary beds of England, and in a Tertiary Clay from Australia. I have myself seen recent specimens from Smyrna, the Levant, and Australia.

#### Genus LOXOCOONCHA, G. O. Sars.

Valves nearly equal, subrhomboidal, and mostly flexuous in outline; surface smooth, or marked with concentrically arranged impressed puncta; or with polygonal fossæ, often also with minute circular papillæ; ventral margin usually forming a prominent compressed keel behind the middle; postero-superior angle obliquely truncate; hinge-joint formed by two small teeth at the extremities of the hinge-line of each valve. Limbs of the animal slender and colourless. Upper antennæ very slender, 6-jointed, the last joint very long, linear, and bearing long simple setæ; lower antennæ 4-jointed, the third joint long and narrow. Flagellum long and biarticulate. Mandibular palp

3-jointed, bearing a distinct branchial appendage. Lowest seta of the branchial plate of the first pair of jaws deflexed. Feet long and slender, alike in male and female. Abdomen terminated by a hairy conical process; postabdominal lobes bearing two moderately long, subequal setæ.

*LOXOCONCHA LATISSIMA*, nov. sp. (Plate LXVIII. figs. 1 *a*–1 *d* ♀, 1 *e*–1 *h* ♂.)

Carapace of the *female* very tumid: as seen from the side, subrhomboidal, of nearly equal height throughout; height equal to two thirds of the length; the extremities are obliquely rounded, dorsal margin almost straight, ventral sinuated in front of the middle. Outline as seen from above broadly and regularly ovate, greatest width situated in the middle and equal to nearly two thirds of the length, extremities mucronate. Surface smooth, marked with numerous small impressed punctures, and on the anterior and ventral surfaces by longitudinal striæ. Length  $\frac{1}{42}$  inch (0.60 millim.).

The shell of the *male* is longer ( $\frac{1}{33}$  inch) and more compressed.

*L. latissima* occurs in both beds of the Sables inférieurs and also in the “zone à Bryozoaires” of the Sables moyens. It was moderately abundant in all these formations.

*LOXOCONCHA BITRUNCATA*, nov. sp. (Plate LXVIII. figs. 2 *a*–2 *d*).

Carapace, as seen from the side, oblong, subrhomboidal; extremities rounded, the posterior produced in the middle; dorsal margin nearly straight, ventral strongly convex; greatest height equal to fully half the length. Seen from above the outline is oblong, quadrangular, with wide truncate extremities and subparallel sides, which, however, bulge out in the middle; width equal to half the length. Surface of the shell covered with large and closely-set polygonal excavations. Length  $\frac{1}{40}$  inch (0.65 millim.).

This species was found in the *Trophon*-bed of the Sables supérieurs and in the *Isocardium*-bed (Sables moyens). In the former it is very abundant, and in the latter moderately so. It is a very well marked and distinct species, very similar in style of surface-marking to *L. guttata* (Norman), but wholly different from it or from any described species in the shape of the shell.

*LOXOCONCHA GRATELOUPIANA* (Bosquet). (Plate LXVIII. figs. 3 *a*–3 *g*.)

*Cythere grateloupiana*, Bosquet, Entom. foss. terr. Tertiair. France, &c., p. 81, pl. iv. fig. 3.

Carapace of the *male* (?), as seen from the side, subrhomboidal; height equal to more than half the length; extremities obliquely rounded, the posterior bevelled off above the middle; dorsal margin straight, ventral slightly sinuated in front of the middle. Outline as seen from above regularly ovate, with projecting, sharply mucronate extremities, width about equal to the height. End view nearly circular. Surface marked with moderately large subrotund pittings, which have a tendency to arrange themselves in flexuous sublongitudinal rows, especially towards the margins of the valves. Length  $\frac{1}{34}$  inch (0.75 millim.).

Found rather sparingly in both beds of the Sables inférieurs, and also in the zone à *Isocardium cor* (Sables moyens).

LOXOCONCHA VARIOLATA, nov. sp. (Plate LXVIII. figs. 4 *a*–4 *d*.)

?*Cythere subtriangularis*, Speyer, Ostracoden der Casseler Tertiärbild. p. 26, pl. ii. fig. 6.

Carapace, as seen from the side, oblong, subrhomboidal; anterior and posterior extremities almost exactly alike, rounded below and bevelled off above the middle; dorsal margin straight, ventral convex and slightly sinuated in front; height equal to more than half the length. Seen from above, ovate, tapering rather suddenly to the extremities, which are sharply mucronate; width about equal to the height. End view subquadrate, somewhat narrowed and rounded off at the apex. Shell-surface marked by rather large polygonal excavations, which tend to run in longitudinal rows, especially towards the anterior margin and on the ventral surface. Behind the middle of the ventral margin the valves are produced into a distinct but not very prominent angulated alæform ridge. This, however, is absent or obsolete in some specimens, which seem to belong to this species, as they agree with it in other respects. Length  $\frac{1}{38}$  inch (0.66 millim.).

This species may very possibly be identical with *Cythere subtriangularis*, Speyer, the figures of which agree almost entirely with it, except in the absence of any angulated ridge; for the present, however, I prefer to consider it as distinct. *Cythere hastata*, as figured by Egger and (more doubtfully) by Reuss, are also either the same or nearly allied forms; without examination of authentic specimens it is impossible to pronounce with certainty. Lastly, the species described by myself (*Loxoconcha angustata* and *L. alata*) are both nearly allied but distinct, as also is *L. multifora* (Norman).

*L. variolata* has been found pretty plentifully in the *Pectunculus*-bed and in the zone à Bryozoaires, and less abundantly in the *Panopæa-menardi* bed (Edeghem and Kiel).

#### Genus XESTOLEBERIS, G. O. Sars.

Shell smooth and polished, ornamented with small, round, distant papillæ, much lower in front than behind, in the *female* very tumid behind; hinge-joint formed by a dentated projecting crest of the left, which is received into an excavation of the right valve; ventral margin of both valves incurved in front of the middle. Upper antennæ 6-jointed, the last four joints successively decreasing in length and bearing very short simple setæ; lower antennæ short, 4-jointed. Flagellum of moderate length. Mandible-palp 4-jointed. Branchial appendage small and bearing only two setæ. Maxillæ as in *Loxoconcha*. Feet short. Postabdominal lobes bearing two setæ. Eyes distinct. Ova and immature young borne within the shell of the female.

XESTOLEBERIS DEPRESSA, Sars. (Plate LXVI. figs. 8 *a*–8 *d*.)

*Xestoleberis depressa*, G. O. Sars, Oversigt af Norges marine Ostracoder, p. 68 (1865); Brady,

Monogr. Recent Brit. Ostrac. p. 438, pl. xxvii. figs. 27–33 (1868); Brady, Crosskey, and Robertson, Monog. Post-tert. Entom. Scotland, &c. p. 190, pl. vii. figs. 13–19 (1874).

? *Cytherina tumida*, Reuss, Foss. Entom. österr. Tertiär-beck. p. 57, pl. viii. fig. 29 (1850); Egger, Ostrak. Miocän-Schicht. Orenburg, p. 17, pl. ii. fig. 11 (1858).

? *Cytherina impressa*, Reuss, Foram. u. Entom. Kreidemergels v. Lemberg. (Haidinger's Abhandl. band iv. 1850) p. 48, pl. vi. fig. 5.

Carapace of the female, as seen from the side, subsemicircular or subreniform, highest in the middle, height equal to more than half the length, depressed and rounded off in front, broadly rounded behind; superior margin boldly arched, inferior very slightly sinuated in front of the middle. Seen from above, broadly ovate, widest behind the middle, width equal to two thirds of the length, pointed in front and broadly rounded behind. End view subtriangular, with rounded angles and convex sides, width greater than height. Surface of the shell perfectly smooth. Length  $\frac{1}{40}$  inch (0.65 millim.).

This is a widely distributed and common recent species, living usually in depths of from 2 to 30 fathoms, occurring in all parts of the North Sea and as far as Spitzbergen and Canada. It occurs commonly as a Post-tertiary fossil in Scotland and in Norway and Canada. In the Antwerp sands a few specimens only occurred in the Sables moyens (zone à Bryozoaires).

#### Genus CYTHERURA, G. O. Sars.

Valves unequal and dissimilar in form, right more or less overlapping left on dorsal margin; surface reticulated, punctated, deeply excavated or bearing irregularly-disposed ribs or protuberances, mostly marked with a central areola of darker colour than the rest of the shell; posterior extremity produced into a more or less prominent beak. Superior antennæ shortly setose, 6-jointed, gradually tapering; second joint bearing a rather long seta on the middle of the posterior margin; inferior antennæ 5-jointed, terminal claws short. Flagellum long, inarticulate. Mandibles robust, with very blunt teeth. Palp 3-jointed. Branchial appendage small and bearing only two recurved setæ. Terminal lobes of the first pair of maxillæ long and narrow. Branchial plate bearing on its external margin two non-ciliated setæ, which are directed downwards and arise from a separate lobe. Feet small, the terminal claws short and curved. Eyes distinct. Copulative organs of male very complex, provided with several irregular processes, and a very long spirally convoluted tube; usually very minute.

CYTHERURA BROECKIANA, nov. sp. (Plate LXIX. figs. 5 a–5 d.)

Carapace, seen laterally, suboval, highest in the middle; height equalling more than half the length; anterior extremity rounded; posterior produced about the middle, but scarcely beaked; dorsal margin boldly arched, somewhat flattened in the middle; ventral slightly convex. Seen from above, ovate; sides nearly parallel, tapering suddenly to the extremities, which are obtusely pointed; width equal to the height. End view sub-

triangular, with rounded angles and broad base, tapering upwards; surface of the shell smooth, marked by a few very small, distant punctations, and by exceedingly faint longitudinal striæ. Length  $\frac{1}{50}$  inch (0.5 millim.).

The shell of the male (fig. 5 *e*) is much more attenuated and tapering at the hinder extremity.

This species occurred very sparingly in the two beds of the Sables inférieurs. It is very closely allied to (though somewhat different in shape from) *C. fulva*, a species described by myself and Mr. Robertson from dredgings made at the Scilly Islands. I have much pleasure in naming this species in honour of M. Ernest Vanden Broeck, not only as a personal acknowledgment of his courtesy to myself, but as a tribute to his services to science in the investigation of the geology of Belgium &c.

CYTHERURA CORNUTA, Brady. (Plate LXVI. figs. 7 *a*–7 *d*.)

*Cytherura cornuta*, Brady, Monogr. Recent Brit. Ostrac. p. 445, pl. xxxii. figs. 12–15 (1868); Brady, Crosskey, and Robertson, Monogr. Post-tert. Entom. Scotland, &c., p. 199, pl. xiii. figs. 23–25 (1874).

Carapace of the male, as seen from the side, oblong, rhomboidal, nearly equal in height throughout; height equal to half the length; anterior extremity rounded, posterior obliquely truncate and produced above the middle into a large obtuse beak; dorsal and ventral margins nearly straight. Seen from above, the outline is ovate, with two rectangular alæform projections behind the middle; anterior extremity acutely, posterior obtusely pointed; width equal to about two thirds of the length. End view subtriangular, with convex and irregularly crenate sides. Shell-surface sculptured with conspicuous waved longitudinal ridges, and having a rectangular transverse ridge near the posterior extremity, which ridge ends near the ventral margin in a strong cornute projection. Length  $\frac{1}{55}$  inch (0.44 millim.).

One or two examples only of this species have been found in the “zone à Bryozoaires” and “zone à *Panopæa menardi*.” The specimen figured I judge, from its elongated form, to have been probably a male.

Genus CYTHEROPTERON, G. O. Sars.

Valves mostly subrhomboidal, tumid, unequal, and different in shape, the right more or less overlapping the left on the dorsal margin; surface of the shell smooth or variously sculptured, punctate, papillose, reticulated, or transversely rugose; ventral margin produced laterally into a prominent rounded or spinous ala, posterior extremity into a more or less distinct beak; hinge formed by two small terminal teeth on the right, and by a minutely crenated median bar on the left valve. Upper antennæ shortly setose and composed of five joints; penultimate joint elongated, and bearing on the middle of the anterior margin two hairs; lower antennæ distinctly 5-jointed. Flagellum long. Mandibles of moderate size. Palp 3-jointed. Branchial appendage bearing two



very small setæ. Jaws as in *Cytherura*. Feet long and slender, terminal claws slender. Abdomen ending in a long, narrow process; postabdominal lobes bearing three short hairs. Copulative organs of the male armed behind with three spiniform processes, one of which is trifurcate. Eyes wanting.

CYTHEROPTERON LATISSIMUM, Norman. (Plate LXIX. figs. 1 *a*–1 *d*.)

*Cythere latissima*, Norman, Nat.-Hist. Trans. Northumberland and Durham, vol. i. p. 19, pl. vi. figs. 5–8 (1865); Brady, Trans. Zool. Soc. vol. v. p. 381, pl. lxii. figs. 4 *a*–*e* (1866).

*Cytheropteron convexum*, Sars, Oversigt af Norges marine Ostrac. p. 80 (1865).

*Cytheropteron latissimum*, Brady, Monog. Recent Brit. Ostr. p. 448, pl. xxxiv. figs. 26–30; Brady, Crosskey, and Robertson, Monog. Post-tert. Entom. Scotland, &c. p. 202, pl. viii. figs. 19–23.

Carapace, as seen from the side, subovate, highest in the middle, height equal to two thirds of the length; anterior extremity rounded, posterior rounded but angulated above, scarcely beaked; dorsal margin boldly and evenly arched; ventral convex, sinuated in front. Seen from above, nearly rhomboidal, greatest width behind the middle and equal to two thirds of the length, extremities acuminate. End view equilaterally triangular, sides convex. Surface marked with oblong pits, which are arranged in flexuous transverse grooves; ventral surface longitudinally furrowed; lateral alæform process rounded and not very prominent. Length  $\frac{1}{42}$  inch (0.60 millim.).

This species is widely distributed in the present day over the North Sea, and as far as Baffin's Bay and Spitzbergen. It occurs commonly as a fossil in the Post-tertiary beds of Scotland, at Bridlington in England, and also in Canada. The specimens here described are from the *Panopæa*-bed (Sables inférieurs), and the zone à Bryozoaires (Sables moyens).

CYTHEROPTERON INTERMEDIUM, nov. sp. (Plate LXIX. figs. 3 *a*–3 *c*.)

Carapace, as seen from the side, oblong, rounded in front, produced behind into a broad obtuse median beak; dorsal margin moderately arched, ventral nearly straight. Seen from above, rhomboidal, greatest width situated behind the middle, and equal to two thirds of the length; the lateral margins end abruptly in a rectangular projection behind the middle, the hinder third of the shell being much narrower, and forming an acutely tapering process; the anterior extremity is also sharply pointed. End view triangular, with nearly straight margins and acute angles. Surface of the shell slightly furrowed transversely, otherwise smooth. Length  $\frac{1}{50}$  inch (0.50 millim.).

A few examples only were found, in the *Panopæa*-bed (Edeghem).

CYTHEROPTERON GRADATUM (Bosquet). (Plate LXIX. figs. 4 *a*–4 *d*.)

*Cythere gradata*, Bosquet, Entom. fossil. terr. Tertiair. France, &c. p. 127, pl. vi. figs. 11 *a*–*d* (1852).

*Cythere papilio*, Egger, Ostrak. der Miocæn-Sch. Orenburg, p. 42, pl. vi. fig. 9.

*Cythere bilacunosa*, Speyer, Die Ostrac. Casseler Tertiärbild. p. 34, pl. iv. fig. 6 (1863).

Carapace, as seen from the side, oblong, quadrangular, slightly higher in front than

behind, height equal to nearly half the length; anterior extremity rounded, subtruncate; posterior produced in the middle into a very acute beak, the upper half being obliquely truncate and jagged, the lower half excavated into two large rectangular indentations; dorsal margin straight, ventral slightly sinuated. Outline as seen from above lancet-shaped, with a large triangular projection in the middle, behind; widest behind the middle, width equal to nearly two thirds of the length; the anterior extremity is pointed and broadly rounded, as a lancet; lateral margins nearly straight to near the hinder extremity, then suddenly sinking so as to form one and then a second rectangular excavation; posterior extremity acuminate. End view irregularly arcuate, width considerably greater than the height; surface of the shell irregularly waved and nodulated, the posterior portion marked by two prominent and sharply defined transverse ridges, which end below in sharp rectangular processes, and above are continued in longitudinal curves toward the middle of the valves. Length  $\frac{1}{4\frac{1}{2}}$  inch (0.60 millim.).

A few specimens only found, in the *Pectunculus*-bed (Sables inférieurs) and zone à Bryozoaires (Sables moyens). It has been found by M. Bosquet in several Eocene deposits in France and Belgium, by Egger in the Miocene of Orenburg, and by Speyer in the Eocene of Cassel.

CYTHEROPTERON PIPISTRELLA, nov. sp. (Plate LXIX. figs. 2 a-2 d.)

Carapace, as seen from the side, subrhomboidal, with a very large and acutely produced triangular alæform process, which projects below the middle of the ventral margin; anterior extremity rounded, posterior produced in the middle into a wide truncated beak; dorsal margin excessively arched, gibbous, highest in the middle; ventral margin convex, hidden in the middle by the projection of the ventral ala. Seen from above, broadly sagittate, the lateral alæ spreading widely, and forming behind the middle of the shell two acute backward-pointing processes, between which and the posterior extremity the margins form a deeply excavated arch; the extreme width between the apices of the alæ is just equal to the length of the shell. End view acutely triangular, the lateral margins nearly straight, ventral margin deeply arched and obscured in the middle by a triangular projection formed by the anterior margin. Surface smooth; lateral alæ channelled and marked by a deep hollow at the base. Length  $\frac{1}{2\frac{1}{5}}$  inch (1 millim.).

This very fine species occurred not uncommonly in the Sables moyens (zone à Bryozoaires).

Genus BYTHOCY THERE, G. O. Sars.

Valves subequal, smooth or very sparingly sculptured, almost destitute of hairs; thin and fragile; hinge-joint quite simple, or composed of a slight bar and furrow; no teeth. Upper antennæ elongated, 7-jointed; second joint large and thick, with a seta on each margin, the other joints much narrower. Lower antennæ moderately robust, 4-jointed; second joint large. Mandibles strongly toothed; palp 4-jointed, with a well-

developed branchial plate. Terminal lobes of first maxillæ short and thick. Branchial plate large and ovate, setose, and with four long deflexed setæ at base. Feet elongated, with long, slender claws. Abdomen ending in a large acuminate process; post-abdominal lobes narrow, and bearing three hairs. Eyes mostly absent.

BYTHOCYTHERE CONSTRICTA, Sars.

*Bythocythere constricta*, G. O. Sars, Oversigt af Norges marine Ostrac. p. 85; Brady, Monog. Recent Brit. Ostr. p. 451, pl. xxxv. figs. 47-52; Brady, Crosskey, and Robertson, Monog. Post-tertiary Entom. Scotland, &c., p. 208, pl. xvi. figs. 9, 10.

Carapace, as seen from the side, rhomboidal; height nearly equal throughout, and exceeding half the length; anterior extremity obliquely rounded; posterior obliquely truncate, rounded off at its upper angle; dorsal margin straight, ventral slightly sinuated near the middle, convex and inclined upwards behind. Seen from above, lozenge-shaped, distinctly constricted in the middle. Surface marked with delicate grooves running mostly in a subconcentric manner, but frequently anastomosing so as to form an irregular reticulation; lateral protuberance rounded and not very prominent; centre of the valves marked by a deep and wide transverse furrow. Length  $\frac{1}{36}$  inch (0.80 millim.).

One imperfect specimen only was found, in the Sables moyens (zone à Bryozoaires); I have therefore been unable to give figures, and have drawn up the description from Scottish Post-tertiary specimens. *B. constricta* occurs in the living state on the coasts of Norway and the British Islands, usually in depths exceeding 10 fathoms.

Genus CYTHERIDEIS, Jones.

Carapace elongated, subovate, depressed in front; hinge-margins nearly simple; shell smooth, punctate, or sometimes grooved; right valve overlapping the left in the centre of the ventral surface. Superior antennæ slender, sparingly setose; last joint short and bearing six short terminal setæ. Mandible slender and curved, with about four very small indistinct teeth: palp 4-jointed, its first joint bearing a conical tooth-like process; third joint bearing a comb-like series of straight, equal setæ, in other respects like that of *Cythere*. First segment of the maxillæ much stouter than the rest.

CYTHERIDEIS (?) LITHODOMOIDES (Bosquet). (Plate LXIII. figs. 2 *a*-2 *d*.)

*Bairdia lithodomoides*, Bosquet, Entom. foss. terr. Tertiair. France, &c., p. 36, pl. ii. figs. 3 *a*-*d*.

Carapace, as seen from the side, oblong ovate, compressed, greatest height situated behind the middle and equal to scarcely half the length, depressed and rounded off in front, wider behind; dorsal margin gently arched, ventral straight or slightly sinuated. Seen from above, regularly ovate, compressed, widest behind the middle, pointed in front, rounded behind, width equal to the height. End view subcircular. Surface smooth, marked on the anterior portion of the shell with a number of shallow concentric grooves. Length  $\frac{1}{26}$  inch (0.98 millim.).

This is one of the commoner species in the Antwerp beds, occurring in most of the deposits which we have examined, and usually in considerable quantity. M. Bosquet obtained it from several of the Eocene and Miocene deposits of France, and states also that he had seen a living specimen from the coast of Holland. In all probability, however, this must have been an example of *Cytheridea elongata*, Brady, which bears a close resemblance to the present species, but is, so far as I can judge, distinct. I have, however, considerable doubt as to the genus to which *C. lithodomoides* should be referred.

CYTHERIDEIS RECTA, nov. sp. (Plate LXIII. figs. 3 *a*–3 *d*.)

Carapace compressed, oblong, somewhat like a grain of rice in shape; seen from the side, linear-ovate, depressed in front, of nearly equal height throughout, height equal to rather more than one third of the length, obtusely pointed in front, rounded behind, dorsal and ventral margins both straight or very slightly convex. Seen from above, narrow ovate, extremities nearly equally pointed, width not more than one third of the length. End view nearly circular. Shell-surface perfectly smooth. Length  $\frac{1}{28}$  inch (0.90 millim.).

Occurs very rarely in the zone à Bryozoaires.

#### Genus PARADOXSTOMA, Fischer.

Shell thin and fragile, smooth, shining; valves subequal, mostly much higher behind than in front, usually elongato-ovate; hinge-joint simple; ventral margins notched in front, so that when the valves are closed there is still an elongated orifice through which the suctorial mouth can be protruded. Upper antennæ very slender, 6-jointed; lower more robust, 5-jointed. Flagellum large and almost as thick as the antenna itself. Mouth suctorial; labrum and labium forming together a large process, projecting downwards and ending in a disk in the middle of which is the orifice of the mouth; mandibles very slender, styliform; palp slender, indistinctly jointed and without branchial appendage. Terminal lobes of first maxilla very narrow. Branchial plate elongated, and having two deflexed setæ at the base. Feet short and robust, claws very short and curved. One eye.

PARADOXSTOMA ENSIFORME, Brady. (Plate LXIV. fig. 2.)

*Paradoxostoma ensiforme*, Brady, Monogr. Recent Brit. Ostrac. p. 460, pl. xxxv. figs. 8–11; Brady, Crosskey, and Robertson, Monog. Post-tert. Entom. Scotland, &c., p. 215, pl. x. figs. 27, 28.

Valves, as seen from the side, somewhat scimitar-shaped, much higher behind than in front, greatest height scarcely equal to half the length and situated behind the middle; anterior extremity obtusely pointed; posterior obliquely rounded, slightly produced above the middle; superior margin boldly arched, inferior gently sinuated in the middle. Seen from above, compressed, ovate, with pointed extremities. Shell smooth. Length  $\frac{1}{35}$  inch (0.75 millim.).

*P. ensiforme* occurs living in the British Seas and in the Levant, and has been found in many of the Post-tertiary deposits of England, Scotland, Wales, and Ireland.

One or two valves only occurred, in the Sables moyens (zone à Bryozoaires).

### Fam. CYTHERELLIDÆ.

#### Genus CYTHERELLA, Bosquet.

Valves elongated, flattened, thick and hard, very unequal; the right much larger than the left, and overlapping throughout the whole circumference, presenting round the entire inner margin a distinct groove, into which the valve of the opposite side is received.

CYTHERELLA PARALLELA (Reuss). (Plate LXII. figs. 2 *a*–2 *c*.)

*Cytherina parallela*, Reuss, "Foram. u. Entom. Kreidemergels v. Lemberg," Haidinger's Abhandl. vol. iv. p. 47, pl. vi. fig. 1 (1850).

? *Cytherella pulchra*, Brady, Trans. Zool. Soc. Lond. vol. v. p. 361, pl. lvii. figs. 1 *a*–*d* (1865).

Carapace, as seen from the side, oblong elliptical, nearly equal in height throughout, height equal to about half the length; extremities rounded; dorsal margin nearly straight, ventral sinuated in the middle. Seen from above, compressed, ovate, width equal to one third of the length. End view ovate. Surface perfectly smooth. Length  $\frac{1}{30}$  inch (0.85 millim.).

This species occurred sparingly in both beds of the Sables inférieurs and in the zone à Bryozoaires of the Sables moyens.

CYTHERELLA ELLIPTICA, nov. sp. (Plate LXII. figs. 6 *a*, 6 *b*.)

Valves, as seen from the side, elliptical, width equal to two thirds of the length; extremities rounded; dorsal margin nearly straight, ventral convex. Seen from above, ovate, widest behind. Surface smooth, with distant round impressed puncta. Length  $\frac{1}{30}$  inch (0.85 millim.).

One valve only of this species was found, in the *Panopæa*-bed of Kiel. It seems to be distinct, but very nearly approaches *C. beyrichi* as figured by Speyer and Bornemann. It is not, however, the *C. beyrichi* of other authors, a form which is in all probability identical with *C. abyssorum* of G. O. Sars, and is so considered by that author.

CYTHERELLA NODOSA, nov. sp. (Plate LXII. figs. 5 *a*–5 *d*.)

? *Cythere varians*, Bornemann, Zeitschr. d. deutsch. geol. Ges. 1855, p. 365, pl. xxi. figs. 4, 5.

Carapace, as seen from the side, elliptical, higher in front than behind, height equal to two thirds of the length; extremities rounded; dorsal margin well arched, ventral nearly straight; the anterior margin raised into a distinct rounded lip; and near the

posterior extremity of each valve are situated two large, polished bead-like tubercles—one near the dorsal, the other near the ventral surface. Seen from above, the outline is somewhat boat-shaped, subtruncate behind; and with wide produced keel in front; greatest width situated in the middle, and equal to less than half the length. End view ovate. Surface of the shell closely pitted with circular puncta. Length  $\frac{1}{40}$  inch (0·65 millim.).

*C. nodosa* occurred in moderate numbers in the *Pectunculus*-bed, and also in the *Panopæa*-beds of Kiel and Edeghem. In general character it is very nearly allied to *C. leioptycha*, Reuss, but differs in minor details, being more tumid, less angular in its contours, and wanting in longitudinal ribs.

### DESCRIPTION OF THE PLATES.

The letters *a*, *b*, *c*, *d* in these illustrations refer to the various aspects of the shell, as follows:—  
*a*, seen laterally; *b*, seen from above; *c*, seen from below; *d*, seen from the front.

#### PLATE LXII.

- |   |   |
|---|---|
| Figs. 1 <i>a</i> –1 <i>d</i> . <i>Cytheridea papillosa</i> , var. | Figs. 4 <i>a</i> , 4 <i>b</i> . <i>Cytheridea mülleri</i> ♀.  |
| <i>lævis</i> .  | Figs. 4 <i>c</i> –4 <i>e</i> . <i>Cytheridea mülleri</i> ♂.   |
| Figs. 2 <i>a</i> –2 <i>c</i> . <i>Cytherella parallela</i> .      | Figs. 5 <i>a</i> –5 <i>d</i> . <i>Cytherella nodosa</i> .     |
| Figs. 3 <i>a</i> –3 <i>d</i> . <i>Cytheridea pinguis</i> .        | Figs. 6 <i>a</i> , 6 <i>b</i> . <i>Cytherella elliptica</i> . |

#### PLATE LXIII.

- |  |  |
|--|--|
| Figs. 1 <i>a</i> –1 <i>d</i> . <i>Cythere tarentina</i> .                    | Figs. 5 <i>a</i> –5 <i>d</i> . <i>Paracypris polita</i> .  |
| Figs. 2 <i>a</i> –2 <i>d</i> . <i>Cytherideis</i> (?) <i>lithodomoides</i> . | Figs. 6 <i>a</i> , 6 <i>b</i> . <i>Pontocypris faba</i> ♀. |
| Figs. 3 <i>a</i> –3 <i>d</i> . <i>Cytherideis recta</i> .                    | Figs. 6 <i>c</i> –6 <i>e</i> . <i>Pontocypris faba</i> ♂.  |
| Figs. 4 <i>a</i> –4 <i>c</i> . <i>Pontocypris propinqua</i> .                | Figs. 7 <i>a</i> –7 <i>c</i> . <i>Bairdia oviformis</i> .  |

#### PLATE LXIV.

- |   |   |
|---|---|
| Figs. 1 <i>a</i> –1 <i>d</i> . <i>Cythere ædichilus</i> .   | Figs. 6 <i>a</i> , 6 <i>b</i> . <i>Cythere plicatula</i> .    |
| Fig. 2. <i>Paradoxostoma ensiforme</i> .                    | Figs. 7 <i>a</i> –7 <i>d</i> . <i>Cythere wetherellii</i> .   |
| Figs. 3 <i>a</i> –3 <i>d</i> . <i>Cythere cicatricosa</i> . | Figs. 8 <i>a</i> –8 <i>d</i> . <i>Cythere latimarginata</i> . |
| Figs. 4 <i>a</i> , 4 <i>b</i> . <i>Cythere cribrosa</i> ?   | Figs. 9 <i>a</i> , 9 <i>b</i> . <i>Cythere limicola</i> .     |
| Figs. 5 <i>a</i> –5 <i>d</i> . <i>Cythere petrosa</i> .     |   |

#### PLATE LXV.

- |   |   |
|---|---|
| Figs. 1 <i>a</i> –1 <i>d</i> . <i>Cythere ellipsoidea</i> . | Figs. 4 <i>a</i> , 4 <i>b</i> . <i>Cythere woodiana</i> . |
| Figs. 2 <i>a</i> –2 <i>h</i> . <i>Cythere jurinei</i> .     | Figs. 5 <i>a</i> –5 <i>d</i> . <i>Cythere plicata</i> .   |
| Figs. 3 <i>a</i> , 3 <i>b</i> . <i>Cythere belgica</i> .    |   |



## PLATE LXVI.

- |   |   |
|---|---|
| Figs. 1 <i>a</i> –1 <i>d</i> . <i>Cythere polytrema</i> .       | Figs. 6 <i>a</i> –6 <i>d</i> . <i>Cythere macropora</i>       |
| Figs. 2 <i>a</i> , 2 <i>b</i> . <i>Cythere scabropapulosa</i> . | (young).  |
| Figs. 3 <i>a</i> , 3 <i>b</i> . <i>Cythere dawsoni</i> ?        | Figs. 7 <i>a</i> –7 <i>d</i> . <i>Cytherura cornuta</i> .     |
| Figs. 4 <i>a</i> –4 <i>d</i> . <i>Cythere trapezia</i> .        | Figs. 8 <i>a</i> –8 <i>d</i> . <i>Xestoleberis depressa</i> . |
| Figs. 5 <i>a</i> –5 <i>d</i> . <i>Cythere acuticosta</i> .      |   |

## PLATE LXVII.

- |   |   |
|---|---|
| Figs. 1 <i>a</i> –1 <i>d</i> . <i>Cythere macropora</i> . | Figs. 3 <i>a</i> –3 <i>d</i> . <i>Cythere mucronata</i> .   |
| Figs. 2 <i>a</i> –2 <i>d</i> . <i>Cythere jonesii</i> .   | Figs. 4 <i>a</i> –4 <i>d</i> . <i>Cythere subcoronata</i> . |

## PLATE LXVIII.

- |   |  |
|---|--|
| Figs. 1 <i>a</i> –1 <i>d</i> . <i>Loxoconcha latissima</i> ♀. | Figs. 3 <i>a</i> –3 <i>g</i> . <i>Loxoconcha grateloupiana</i> : |
| Figs. 1 <i>e</i> –1 <i>h</i> . <i>Loxoconcha latissima</i> ♂. | 3 <i>a</i> –3 <i>d</i> , young male? 3 <i>e</i> , adult          |
| Figs. 2 <i>a</i> –2 <i>d</i> . <i>Loxoconcha bitruncata</i> . | female; 3 <i>f</i> , 3 <i>g</i> , adult male.                    |
| Figs. 4 <i>a</i> –4 <i>d</i> . <i>Loxoconcha variolata</i> .  |  |

## PLATE LXIX.

- |   |   |
|---|---|
| Figs. 1 <i>a</i> –1 <i>d</i> . <i>Cytheropteron latissimum</i> .  | Figs. 5 <i>a</i> –5 <i>d</i> . <i>Cytherura broeckiana</i> ♀.   |
| Figs. 2 <i>a</i> –2 <i>d</i> . <i>Cytheropteron pipistrella</i> . | Fig. 5 <i>e</i> . <i>Cytherura broeckiana</i> ♂.                |
| Figs. 3 <i>a</i> –3 <i>c</i> . <i>Cytheropteron intermedium</i> . | Figs. 6 <i>a</i> –6 <i>e</i> . <i>Cytheridea cypridioides</i> . |
| Figs. 4 <i>a</i> –4 <i>d</i> . <i>Cytheropteron gradatum</i> .    |   |

















1<sup>a</sup>



1<sup>b</sup>



1<sup>c</sup>



1<sup>d</sup>



2<sup>a</sup>



2<sup>b</sup>



2<sup>c</sup>



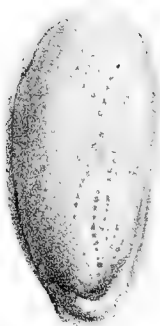
2<sup>d</sup>



2<sup>e</sup>



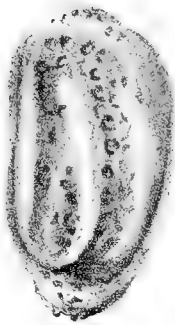
3<sup>a</sup>



3<sup>b</sup>



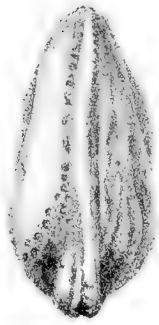
4<sup>a</sup>



4<sup>b</sup>



4<sup>c</sup>



5<sup>d</sup>

5<sup>e</sup>

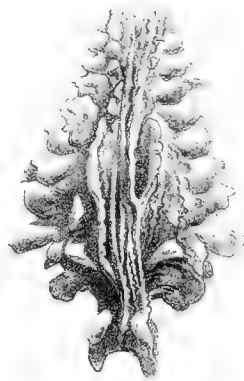
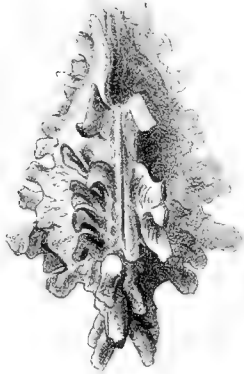
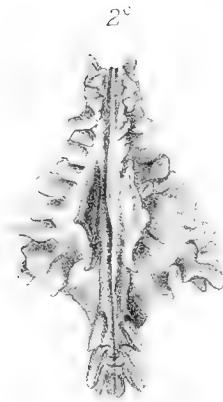
6<sup>a</sup>







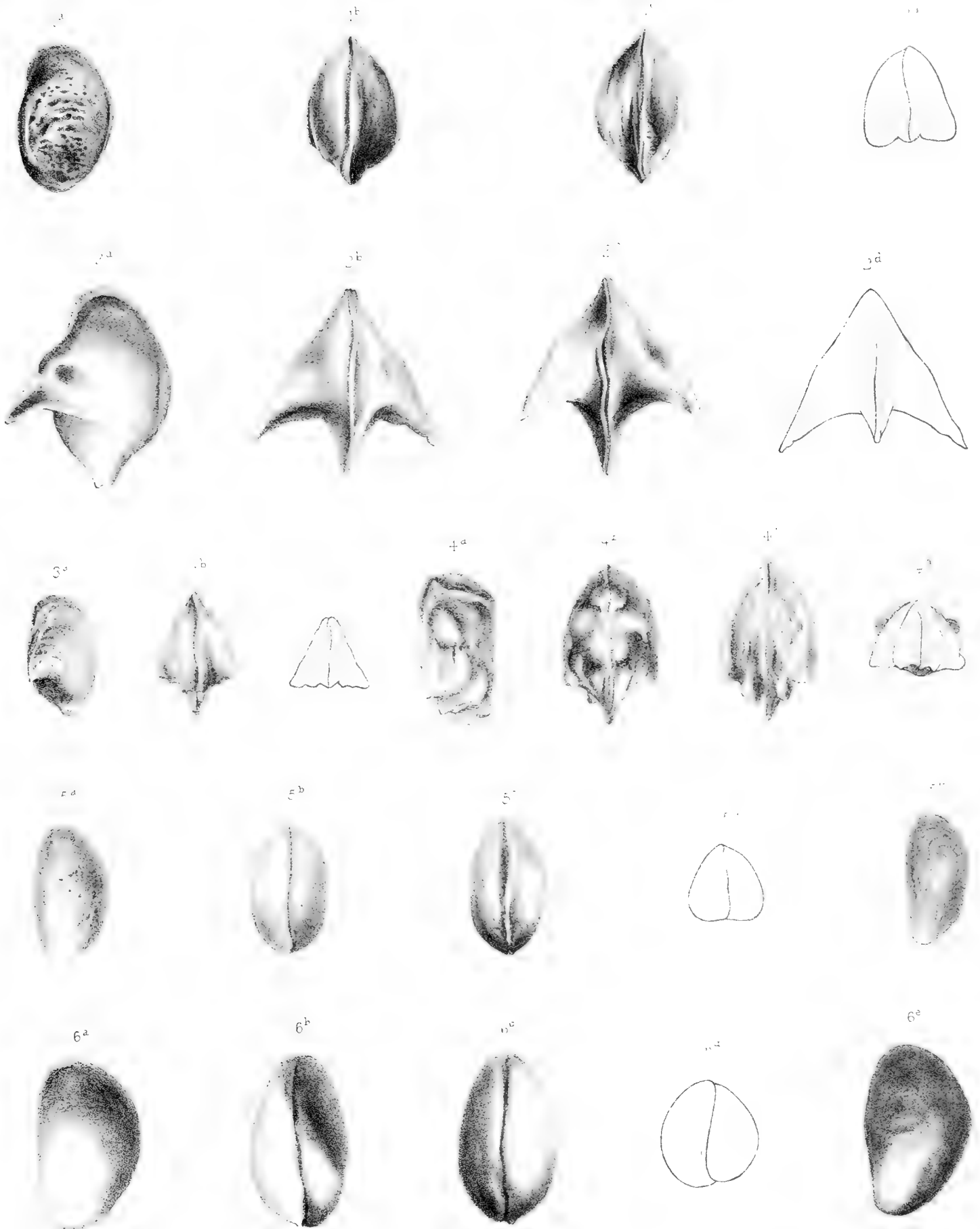














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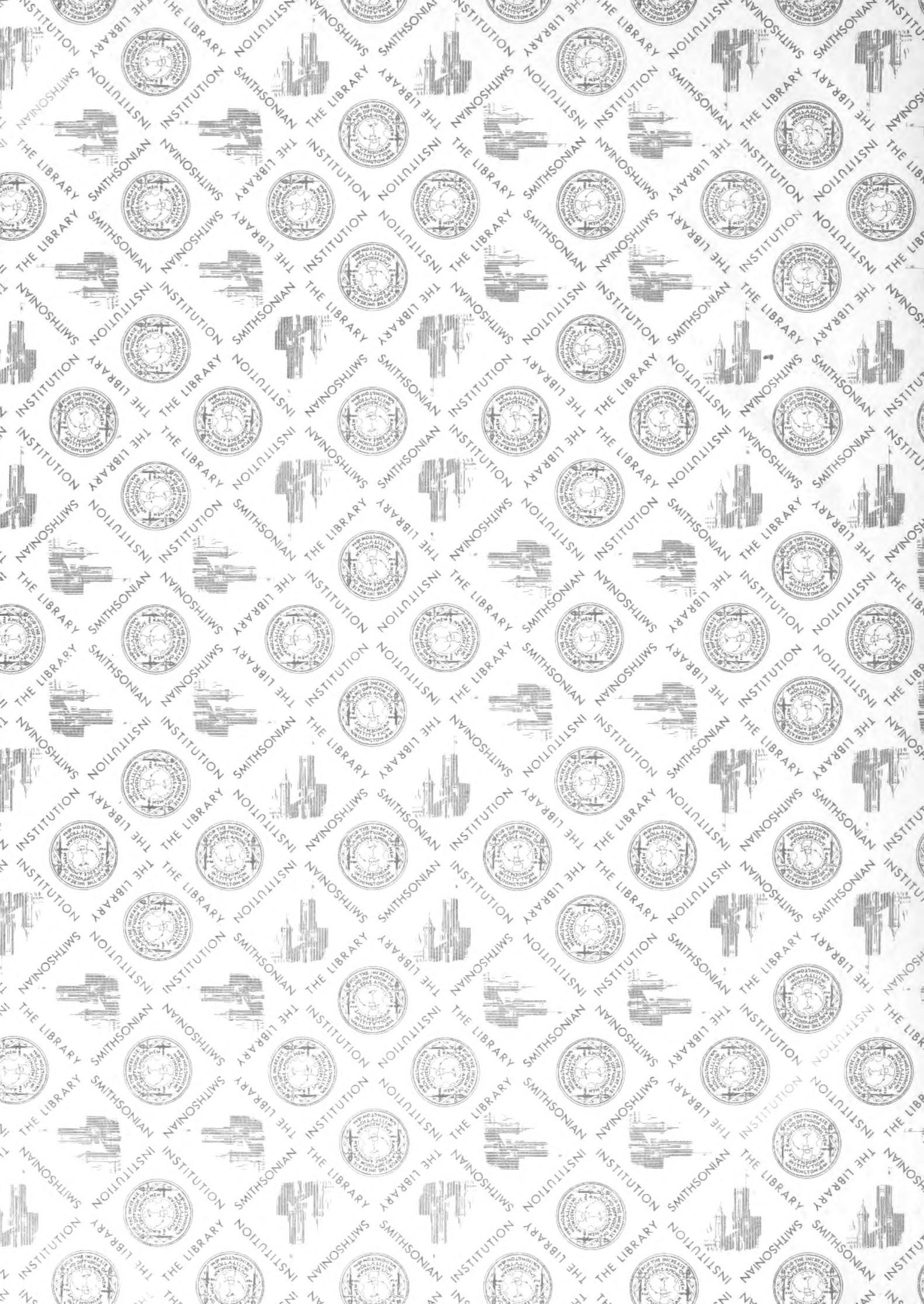
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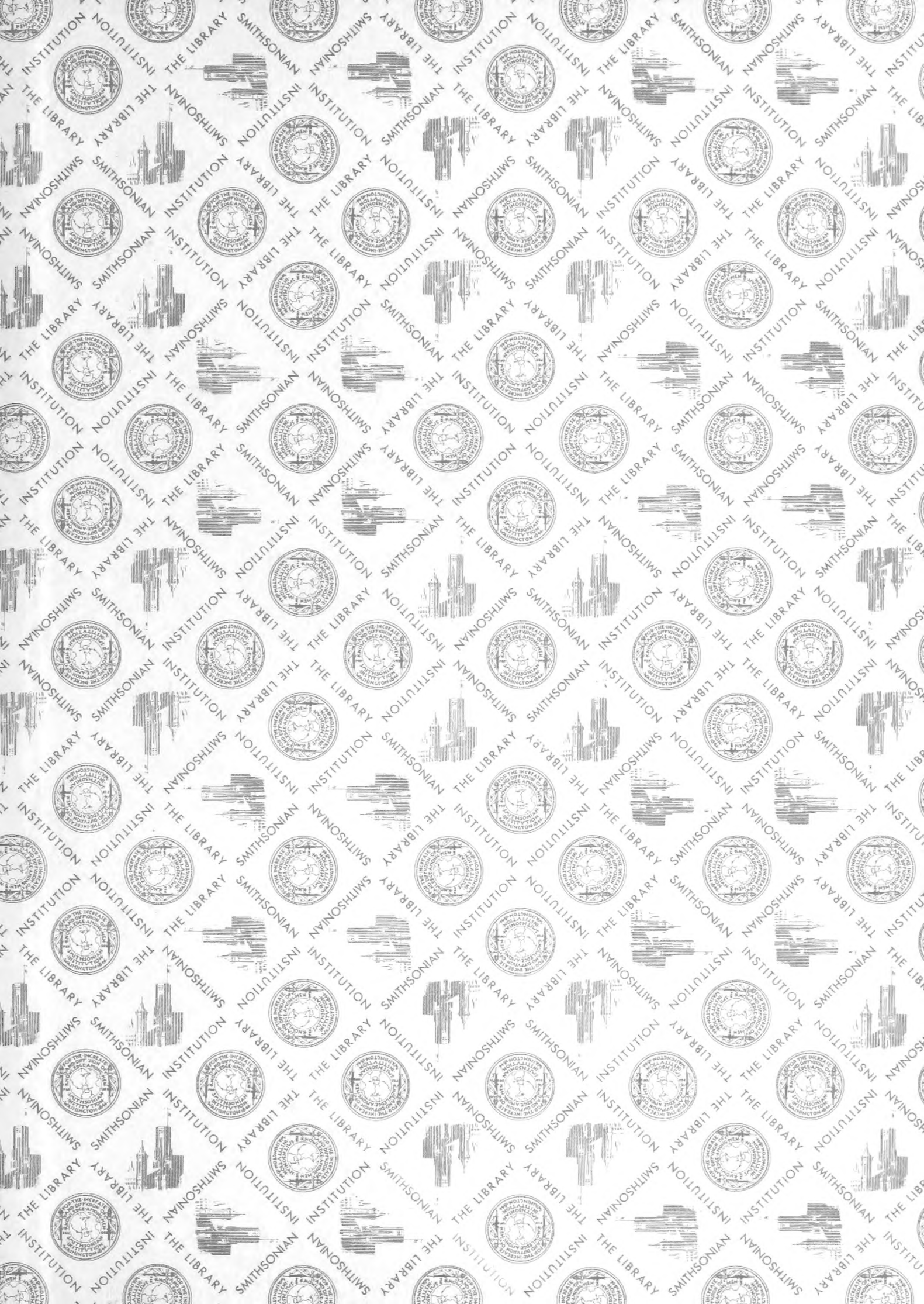












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